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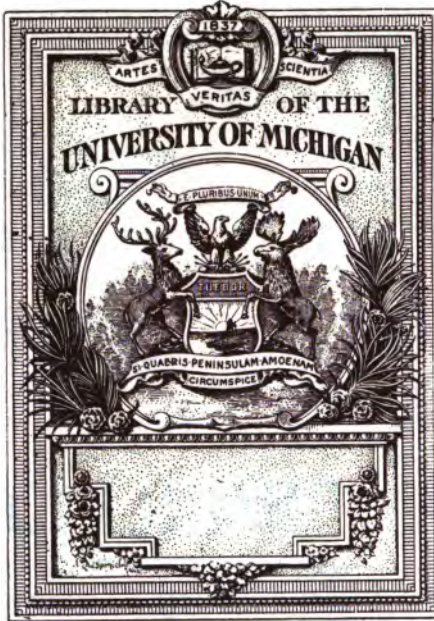
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BY

FRANCIS G. BURTON, A.S.A.A.

(Formerly Secretary and General Manager of "The Milford Haven Shipbuilding and Engineering Company, Limited"; Author of "Engineering Estimates and Cost Accounts," "The Naval Engineer and the Command of the Sea," "The Commercial Management of Engineering Works," &c., &c., &c.)

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Without aiming at giving an exhaustive account of the manner in which each separate business is conducted, the technical points in connection with each industry will receive as much attention as is necessary in order fully to elucidate the system of accounts advocated, while each volume will be the work of one who has made that particular class of accounts more or less

a speciality. It is obvious, however, that to enable the necessary ground to be covered in the space available, it is incumbent to assume upon the part of the reader a certain knowledge of general bookkeeping. The extent of the knowledge assumed will vary according to the nature of the class of accounts considered. For example, in the volumes on "Bank Accounts" and "Shipping Accounts" a thorough acquaintance with ordinary double-entry bookkeeping is not unnaturally assumed; but in the case, for instance, of "Auctioneers' Accounts," "Domestic Tradesmen's Accounts," and other similar volumes, such explanations are included as will enable the ordinarily intelligent reader fully to grasp the methods described even although his knowledge of bookkeeping may be of an elementary description. These explanations are, doubtless, superfluous as far as accountants are concerned, but are necessary to make the volumes of value to the majority of those specially engaged in these particular industries.

To subscribers for the whole series it may be added that, when completed, it will form a most valuable and practically complete library, dealing, at the hands of specialists, with practically every class of accounts, and illustrating the application of the theory of double-entry as described in general works on bookkeeping.

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EDITOR'S PREFACE.

V.

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<i>Polytechnic Accounts.</i>	<i>Tailors' Accounts.</i>
<i>Printers' Accounts.</i>	<i>Theatre Accounts.</i>
<i>Publishers' Accounts.</i>	<i>Wine Merchants' Accounts.</i>

Arrangements for dealing with other subjects are now in progress, and the Editor wishes to add that he will be glad to receive suggestions and offers from accountants of experience for the undertaking of volumes not yet announced.

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ENGINEERS' AND SHIPBUILDERS' ACCOUNTS.

CHAPTER I.

INTRODUCTORY.

ONE of the first considerations with the accountant in preparing a new set of books is to arrange them so that they may not only record the transactions of the business, but may also assist the proprietor or manager in conducting it. This is more particularly the case when involved transactions—such as arise in manufacturing concerns—have to be recorded, because each purchase, or payment, will usually pass through a sequence of transfers, and not be charged immediately to the Trading Account. Professor Dicksee, in his “Bookkeeping for Accountant Students,” says two objects have to be arrived at:—

“(1) That the record be so explicit that, at any subsequent time, the exact nature of the transaction may be readily perceived without the aid of the memory.

“(2) That the transactions should be so classified that at any time the total result of such transactions during any given period may be readily ascertained.”

The business of a Shipbuilder or Engineer presents peculiar difficulties in this respect. Within the same yard there are

numerous different trades—shipwrights, millwrights, blacksmiths, moulders, machinists, platers and rivetters, fitters, joiners, pattern makers, painters, &c. The cost and value of the work of each of these trades must, in some way or other, be ascertained, whilst at the same time a record must be kept of the cost of each contract, and sometimes of sectional portions of contracts. It will readily be perceived that such conditions demand modification of the nominal accounts in the financial books, and the provision of special statistical, or memorandum, books. In well regulated Engineering firms elaborate Cost Accounts are kept; in nearly all some attempt is made to ascertain the prime cost of work executed; but, alike in the more elaborate and the less pretentious cost bookkeeping, misleading errors frequently arise through an imperfect system and an improper allocation of establishment charges being pursued. This is particularly unfortunate, because of the many purposes for which such accounts are used. Although it may appear paradoxical to the shareholder or the auditor, it is, nevertheless, perfectly true that the superintending Engineer makes far more use in the management of his business of such Cost Accounts as he may possess than he does of his Nominal Ledger, or other financial books. The reason is not far to seek. Whilst a textile manufacturer or textile merchant is guided, and limited in his transactions, by his immediate market (which market is a definite price for a definite article), the Engineer has to consider a number of complex factors extending over a long period, which, at best, are only partially represented in his Trading Account—a fluctuating market for materials; the existence of patterns, or the cost of making them; the prospect of labour troubles; the extent of purchases of finished materials which will have to be made; and the time and machinery which will be occupied in the constructions. Some of the tenders he is asked for have to be rendered within a very limited time, and if he can readily consult the records of previous similar (or

analogous) structures, the task of fixing his tender price will be considerably lightened. Again, after the contract is signed, it is desirable to compare the progress of actual cost with the detailed estimate, so that expenditure which is progressing on certain portions at an undue rate may be curtailed, or a more liberal interpretation given to other portions of the specification on which profits are accruing greater than those anticipated. In some constructions, like that of a large ocean steamship, there is generally a margin on such items as cabin fittings, stores, and spare gear; whilst the alteration of any portion of the specification (a frequent incident in shipbuilding) invariably affords opportunity for a little extra profit. To Shipbuilders and Engineers, in these competitive days, Cost Accounts are indeed not a luxury, but a necessity.

In order to prepare these subsidiary, but most important, accounts, it is necessary to have a record of stores consumed, as well as of wages paid, and of the exact work on which they are expended. This cannot easily be done without keeping special books for stores received and issued, and also Wages Sheets which show the various jobs upon which the men are employed, as well as the money earned by them. In arranging these books and sheets care must be taken that they satisfy the second of Professor Dicksee's requirements; they must be so classified that the result of the transactions may be readily ascertained at any time. But in fixing this classification the bookkeeper must be careful that it is one which will answer the purposes of the Engineer, as well as that of the Journal entries suitable for a double-entry set of books. The reason of this will be more apparent when Cost Accounts are specifically considered; but there is one incidental advantage in keeping a Stores Ledger which will commend it to the auditor or the careful manager. A deficiency in Stores at stocktaking can be located by an examination of the detailed Stores Ledger, and the honesty and

carefulness of the men employed in the department thus tested. When the great value of some of the articles of copper, brass, or gun-metal kept in stock in an Engineer's factory is borne in mind, and the facilities such articles afford for dishonest removal, the advantage of this check on the storekeeper and his assistants will be apparent.

Elasticity of arrangement, as well as accuracy of record, is needful for the successful working of Shipbuilders' or Engineers' Cost Accounts. The information required varies at different periods, and under different conditions of work. When a new construction is in progress, or an important alteration being made in an existing machine, the manager requires the most minute division of costs, so that he may know in what sections of work, or in which departments, he must seek to economise. But at other times, when the works are producing machines of standard patterns only, or executing reproductions of previous orders, such sub-divisions are not so necessary; it is then usually sufficient to ascertain the total expenditure on each machine or structure, so as to ensure that it does not exceed a normal amount. Again, when alterations are being made or contemplated in the mode of operating the factory, when a change in motive power is intended, or new forms of machine tools proposed for adoption, the Engineer requires running cost as distinct from cost of work produced. By taking careful observations of time occupied, of oil, grease, and waste used, by assumptions of a percentage of wear and tear, he arrives at conclusions which, so far as they go, are scientifically accurate, but he frequently misses the incidence of establishment charges, and overlooks the effect of appreciation of the Capital Account. His office records should supply him with the factors which, in his own time measurements, are often overlooked, but which are essential for a just balance to be struck between the old style and the new. For these several

reasons it is desirable that Cost Accounts should be based on an elastic system, and that whilst they are built on the same foundation, and in general result must agree with the financial books of the firm, they should not be interlocked with them.

The subject of accounts may be considered from two points of view—Analytically, by resolving the Balance Sheet and Trading Account into their original records; or Synthetically, by building up from the original books of record—from Invoice Book, Day Book, Cash Book, &c.—a final and classified summary of the transactions. In the present treatise the synthetical method will be the more convenient, but the student will find a reversal of the process to be of great utility. As Mr. Herbert Spencer has exemplified in many of his writings, the most cogent method of proving a conclusion is to analyse it.

The books of account needful for an Engineering business, and which are referred to in the following pages, are as under :—

Invoice Book.

Debits to Works Book.

Stores Received Book.

Stores Issued Book.

Stores Ledger.

Wages Book.

Day Book.

Credits to Customers Book.

Cash Book.

Ledgers, Personal.

„ Nominal.

„ Private.

Journal for Transfer Entries.

Cost Books A, B, and C.

In addition to these the usual Shareholders' Ledger and subsidiary books have to be kept for a limited liability company; but these, being common to all such companies, hardly come within our purview. A considerable number of statistical and technical records are also kept by progressive and skilful managers, some of them being prepared in the general office, and others in the drawing or other technical office; but however valuable these records and diagrams may be in conducting the business, and in checking or elucidating the results of it, they are not, properly, accounting, and must be considered to be independent of the financial books, which must be complete in themselves.

CHAPTER II.

MATERIALS AND STORES.

THE businesses we are considering are those in actual work ; the buildings have been erected, the staff appointed, machinery placed in position, and orders obtained which will immediately employ the factory. It is unnecessary to deal with the accounts of either capital subscribed or capital expended until the Balance Sheet is arrived at. In the meantime, the first work of the executive is to obtain a supply of material upon which labour and power can be employed. As it is essential for economical working that no goods should be purchased which will not be required for use in the near future, and that the quality and dimensions of them should be clearly defined, it is desirable that the inception of all orders should be a "Requisition for Stores and Materials," to be submitted to and approved by the directors ; or to specify goods which, being urgently wanted, have been ordered with the sanction of a properly-authorised officer in the intervals between the board meetings. These requisitions will be prepared either by the chief draughtsman or the storekeeper : the former dealing with plates, angles, or bars required to special measurements ; the latter with tin-tacks, tenpenny nails, and the hundred and one articles which constitute his daily issue. The same form may be used by both officers, and the following will be found suitable for the purpose :—

Specimen No. 1.—**THE TENNANT VALE ENGINEERING COMPANY, LIM.**

..... 1902.

The sanction of the Directors is requested to the ordering of the following supplies:—

Date	Description	Quantity Wanted	Estimated Price	Estimated Cost	Proposed to be ordered from
			£ s d	£ s d	
	The following have already been ordered by authority of the Manager:—				

..... *General Manager.*

It will be seen that it is in no sense an "account" within the true meaning of the word, but it affords the directors a very useful estimate of the immediate commitments they are asked to undertake for materials. The orders can be prepared from this list after it has been sanctioned.

The Order Books may be of different forms, but they should contain the most explicit directions, not only to prevent errors in delivery, but also to facilitate future reference and checking. In a Shipbuilder's establishment the drawing office orders are generally prepared by the draughtsmen on loose sheets, so as to ensure accuracy of measurements of plates and angles, and sketches of any special forms required, and these are copied in a Press Copy Book. For the storekeeper's and general orders, counterfoil books can be employed; and for a general mechanical Engineer's office, counterfoil books will usually be found suitable. Whatever forms are employed, however, it is necessary that the invoices should be marked off to

the Order Books as they are received. To ensure this, and methodical examination of the invoices, it is well to mark them with a rubber stamp, the following being suitable for the works under consideration :—

Specimen No. 2.

	(Fo.)	
Goods Received by		
Goods passed by		
Marked off Order Book by		
Prices Checked by		
Calculations Checked by		
Passed for Payment by		
..... <i>Manager.</i>		..... <i>Director.</i>

To facilitate the keeping of the Stores Books as hereafter explained, it is better to correct in red ink any errors in the invoices, and to deduct from them trade discounts and packages to be returned, instead of making these corrections by debit note. The total of the corrected invoice will be the amount brought to account in the financial books.

The invoices, after examination, are ready for the Invoice Guard Book, or the Invoice Register, both of which serve the same purpose, so far as bookkeeping is concerned. The analysis on the right-hand side of the book must be carefully considered, and adapted to the use of each individual factory. The model form marked Specimen No. 3 is suitable for an ordinary machine or engine-building shop, and the column "Sundries" is introduced for the purpose of economising space. The entries of this column must be analysed at the end

of the month into the several accounts involved, but to employ separate columns for each of them would render the book impossibly cumbersome.

In this and some of the following examples shillings and pence are omitted.

This Invoice Book serves all the purposes of a Journal for the purchases of the firm, and at the present time it is not usual in actual practice to journalise such transactions. The postings are made direct from the Guard Book or Register, as indicated by the Column Ledger Folio. The amounts in the left-hand column of the book are posted to the credit of the several vendors, and the totals of the perpendicular columns are posted each month to the debits of the various accounts written at the head. Thus £97 will be placed to the credit of Lloyd & Lloyd in the Ledger for tubes purchased from that firm, but this only forms one of many lots of goods bought during the month, the details of which it is unnecessary to record in the Nominal Account, and the Ledger entry to the debit of Stores Account will therefore be—

To Sundries £1,129.

In some establishments, where complete Stores Books are kept, all purchases of materials are passed through them; but in others, it is usual to charge special purchases, as in Specimen No. 3, direct from the Invoice Book to the account for which they are bought. In this example the monthly totals, £1,129 for Stores and £105 for Timber, will be debited to the store-keeper, who will—through his Stores Issued Book, as hereinafter explained—account for the consumption of the materials by the various departments, or on various jobs of work. On the other hand, Engine Coal and Smithy Coal will be debited direct to those accounts; and purchases made of new machinery, or for immediate use on certain specific items of

work then under manufacture, will be debited (by monthly totals) to New Machinery or the Manufacturing Accounts respectively. A column has been inserted for Building Repairs, but this is of doubtful expediency, as in many instances the materials are already in the store, and issued from there; and in this account (as in all others) nothing should be charged direct to it through the Invoice Book, unless it is intended for *immediate* consumption, and is free from the danger of being accidentally used for some other purpose. The other columns—such as Stationery, Rent, Rates and Taxes, Insurances, &c.—are to provide for charges which will not in any case pass through the storekeeper's books.

For Engineers employed on construction of the larger class of machinery—such as high-power' stationary engines, pumping machinery, marine engines, and steamships—it is convenient to record through the financial books the cost of each contract. This is especially the case with Shipbuilders, as the number of ships in progress at any one time is very limited—seldom ranging above half-a-dozen in a large yard—and a very large proportion of the materials, angles for frames, forgings, and plates, are ordered from the draughtsmen's measurements for the particular purpose for which they are required. Instead, therefore, of charging all such materials, either in the Invoice Book or through the Stores Issued Book, to Manufacturing Account, accounts must be opened in the Ledger, and the corresponding entries made in the subsidiary books for—

Contract (or Ship) No.....

Contract „ No.....

Small Contracts.

Ship Repairs.

The account for small contracts is convenient in a Ship-yard for work like river barges, small boats, and minor girder work,

which is occasionally taken in hand in order to keep the machinery or workmen fully employed.

A large marine engine, or a large ship, is not a single construction, but an aggregation of constructions, each of which may (for cost purposes) be regarded as a separate and independent contract. The highest development of this grouping of structures to form one complete structure is seen in a naval ship. H.M.S. VULCAN, for instance, contains no less than 128 separate engines, with 284 cylinders, in addition to cabin fixtures, and numerous other fittings. It would be difficult to open two hundred or more distinct accounts in the ordinary Ledger for such a vessel, and it is in order to escape doing so that Engineers and Shipbuilders employ detailed, or prime Cost Accounts.

To follow the goods in the first and fourth analytical columns of the Invoice Book, we have in the Stores Received Book an exactly corresponding entry in amount, but with the individual items of the several invoices recorded so that they may be posted to their respective accounts in the Stores Ledger. The invoices are usually rendered monthly, but the goods entered on them may be delivered on many days, or even on every day, of the month, and a record must be taken of them as they are received. This may be done in the Received Book, the amounts of money being entered when the invoices are rendered, or they may be first entered in a rough book, and transferred to the finished record at the month end. The former method is generally preferable, as all the particulars necessary for the postings to the Stores Ledger are readily available, but the result, from a bookkeeping point of view, is the same, and the form marked Specimen No. 4 is suitable for either method.

The total amount of the Stores Received Book must agree monthly with the Stores column of the Invoice Book, or with the Stores and Timber columns of such book. Where little timber is used, and when it can be kept under the immediate supervision of the storekeeper, it can be passed through the Stores Received and Issued Books, separate accounts being opened in the Stores Ledger for each description of wood. In Shipyards, however, and in many of the larger Engineering works, the purchase and consumption of timber is on a large scale, and it is necessary to take special precautions to prevent waste or misuse. Frequently an assistant storekeeper is placed in charge of it. In all cases where the timber dealings are extensive it is desirable to keep separate Timber Books on the same model as the Stores Books, standards and cubical measurements being substituted for the Number and Weight columns of the latter.

Articles are issued from the stores on the presentation of written requisitions, signed by the foremen of the departments demanding them. The form varies in different works, and should be as simple as possible. Messrs. Garcke and Fells, in their excellent work on "Factory Accounts," give a form in which is inserted Weight, Rate, and Amount. These particulars must necessarily appear in the Stores Issued Book, but are certainly not required in the requisition, which is only a temporary voucher. It is, however, essential that the particulars given of the materials shall be sufficiently explicit to ensure the storekeeper issuing just what is required, and that the purpose for which it is required (order number, and detail, or process) be properly inserted. From these temporary requisitions the storekeeper will enter up his Stores Issued Book in the manner given in Specimen No. 5.

STORES ISSUED BOOK.

Specimen No. 5.—

Date	To whom Issued	For what purpose	Goods	Quantity		Price	Amount	Total Issues per Process	Name of Process
				No.	Ton cwt. qrs. lbs.		£ s d	£ s d	
	A. Burgess	Repairs, Machinery	Elbow Pipe .. ..	..	3 0 0	14/-	2 2 0		
	Do.	Do.	Phosphor Bronze Castings	..	..	13d.	6 6		
	Do.	Do.	Finished Rope Pulley, 3 ft. 10 in. drum, 12 grooves..	1	..	£18	18 0 0		
	Edward Jones	Contract No. 57 ..	1½ in. Round Steel Bars ..	..	1 10 0	10/-	15 0 0	20 8 6	Repairs, Machinery
	Do.	Do.	1½ in. by 8 ft. 0 in. Bright Hexagon Steel .. ..	..	1 0 0	£16	16 0		
	Do.	Cleaning Machinery	Waste .. ..	..	5 0 0	2d.	4 13 4	15 16 0	Contract 57
	Do.	Do.	Do. .. ..	..	1 0 0	2d.	18 8		
	Evan Daniel	Contract No. 63 ..	Pig Iron .. ..	..	7 0 0	£11	77 0 0	5 12 0	Oil and Waste
	A. Burgess	Do. ..	Steel Forgings .. ..	..	15 0 0	17/-	12 15 0		
	Do.	Do.	Soft Lead .. ..	..	10 0 0	19/-	9 10 0		
		Other Issues, to be given in detail the same as above,	say	..	..	..	..	99 5 0	Contract No. 63
							653 18 6		
							£795 0 0		

No profit or loss should be made in the Stores Books beyond the loss which is inseparable from the issue of goods in small quantities. The issues given in Example No. 5 are for comparatively large lots, but numerous articles—such as nails, washers, small bolts, screws, and white and red lead—are often issued in lots of a pound or less at a time, and there is always a certain wastage—the “turn of the scale” in weighing out such issues. The quantity entered in the Stores Issued Book will, of course, be the actual quantity weighed or counted out by the storekeeper. The price must be the cost price. In a treatise on Cost Accounts it has been defined that “the cost of an article is the invoice price of it, *plus* the amount which has to be paid for delivery at the works,” and when very accurate detailed costs are required the freight should undoubtedly be debited to the Stores Account and added to the invoice cost, in order to arrive at the issue price of the goods. So long, however, as our coinage continues on its present basis it will be difficult to obtain workable price fractions if freight is included, and the more usual practice, therefore, is to charge Railway and Canal Carriage and Cartage to a Freight Account, for which a column is set apart in the Invoice Book. There is, however, one point to remember in connection with these Stores Issues: Markets are always in a state of “unstable equilibrium,” or approaching such a state, and this condition affects the cost of purchases by the firm, and sometimes to a very considerable extent. It is imprudent to keep adjusting prices, by an average, each time a new purchase is made, and as the consumption of stores will generally follow the same order as their receipt, the issue price should be the same as the buying price of the oldest lot on hand until that is exhausted, and then of the next lot, and so on until stocktaking, when a re-valuation can be made if desirable. This difficulty does not arise in the case of articles specially ordered for a particular contract, as

they are charged through the Invoice Book to that contract, or to Manufacturing Account, at the exact invoice cost.

In shipyards and bridge building works most of the heavy material—such as plates and angles—is ordered to exact sizes, obtained by the draughtsmen from the working drawings or models, or from measurements taken from the mould loft floor, and therefore only the miscellaneous material—which, however, is almost innumerable in variety—will pass through the Stores Books.

Two other subsidiary books are needful in the stores office. First, a Credit to Departments for Articles returned into Stores from the various shops and for scrap, &c. ; and, second, a Debit to Manufacturers for Defective Goods returned to them from the Works (Specimens 6 and 7). These books will correspond with the Stores Received and Stores Issued Books, of which, indeed, they are only divisions, separated from the general receipts and issues for the convenience of reference and of further entries in the accounts. The books for Credit to departments will, in most large Engineering Works, and more especially in Shipyards, contain a great number of entries, for it is essential that no goods issued from the Stores, or charged direct to any job from the Invoice Book, should be used for any other purpose than that for which they were originally issued or charged ; if iron, paint, nails, or any other articles are demanded, as of necessity they always will be demanded, in any excess (however slight) of the requirements for the job then in progress, they must be returned to the storekeeper's charge, and re-issued by him for any like purpose upon which they can be used. Of course, it is not actually necessary to cart a lump of iron from the boiler shop to the Stores and back again (this, however, is a matter of management and not of bookkeeping) ; but it is absolutely necessary that the transaction should be recorded in the books exactly as if the carting to and fro

had taken place. It is impossible to keep correct accounts in an establishment where similar goods are used for many different purposes, *unless there is absolute insistence on the use of the goods being limited to the purpose for which they are issued.*

The bookkeeper has no difficulty in agreeing the debit to Stores Account in his Ledger with the total of Stores Received Book, and in like manner the Stores Issued Book must agree with the credit in the Ledger Account. It will, however, be inconvenient in practice to remove this book from the possession of the storekeeper, and it is better for him to prepare a Return of Stores Issued, either weekly or monthly, for the use of the General Office. An example of this form is given in Specimen No. 8. The total must agree with the total of the

Specimen No. 8.

RETURN OF STORES

issued for month ending 31st October 1901.

Date	Department	On What Account	£ s d	£ s d
	Fitters ..	Repairs, Machinery ..	2 2 0 0 6 6 18 0 0	
	Turners ..	Contract 57	15 0 0 0 16 0	20 8 6
		Cleaning Machinery ..	4 13 4 0 18 8	15 16 0
	Foundry .. Fitters ..	Contract No. 63	77 0 0 12 15 0 9 10 0	5 12 0
		Other issues in detail, say ..	..	99 5 0 653 18 6
			£	795 0 0

Issue Book for the week, or month, and the Return itself may be posted in a Guard Book and used as a Journal, or the transfers may be made in the ordinary Journal.

The two Stores Books described would be of little practical value unless the results could be brought into some summary which will disclose the quantities and kinds of the various goods received, and the manner in which each of such goods is disposed of. In any moderate-sized Engineering Works it is a useless waste of time to search back through an ordinary Day Book for particulars of price or quantity of goods received some considerable time before, and it is impossible for the manager to ascertain in such a way what goods are at the moment in stock, or what the character and rate of consumption has been. To remedy this defect, the Stores Ledger is introduced, an example of which is given in Specimen No. 9. This Ledger should be kept in the Store's Office, and should be posted up daily. It will be seen that, instead of names of persons or accounts, the pages are headed with names of particular sorts of goods. These goods should be divided into sizes—as, for instance: Rivets countersunk, 1", 1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ", 2 $\frac{3}{8}$ ", 2 $\frac{1}{2}$ ", 2 $\frac{7}{8}$ "; and Rivets, snapheaded, 1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ", 2", 2 $\frac{3}{4}$ ", 3", 3 $\frac{1}{4}$ ", each of which sizes should occupy a separate place in the Ledger. Of course, it is sometimes possible to group several sizes of the same article, or, in paints, several colours of the same class together; but this is a matter of yard management rather than of accounts. The general principle is that sizes, as well as descriptions, of goods must be kept distinct. The money debits to the Ledger are the same as those in the Stores Received Book, and the money credits are the same as those in the Stores Issued Book. If, therefore, at stock-taking the balances of the Stores Ledger are taken out in money, the total will agree with the balance of the Stores Account in the Office Ledger of the firm, and with the difference

Specimen No. 9.

STORES LEDGER.

STEAM TUBES.

Dr.

Cr.

	No.	T. C. Q. lbs.	Price	£ s d	No.	T. C. Q. lbs.	Price	£ s d
Lloyd & Lloyd		6 18 2 12	14/-	97 0 0	Issues do. ..	3 0 0 0	14/-	42 0 0
					Stock carried forward ..	2 0 0 0	14/-	28 0 0
						1 18 2 12	14/-	27 0 0
Stock brought forward ..		6 18 2 12	£ 97 0 0			6 18 2 12	£ 97 0 0	
		1 18 2 12	14/-	27 0 0				

5" x 3" x 3/8" ANGLE BARS.

Dr.

Cr.

Dugdale Iron Co.	10	0	0	0	£10	100	0	0	Issues	1	0	0	0	£10	10	0	0
..									do.	3	10	0	0	"	35	0	0
									do.	2	0	0	0	"	20	0	0
									Stock carried forward	3	10	0	0	"	35	0	0
Stock brought forward	10	0	0	0	£100	0	0	0		10	0	0	0	£	100	0	0
..	3	10	0	0	£10	35	0	0									

4" x 3" x 1/8" ANGLE BARS.										Cr.								
										No.	T. C. Q. lbs.	Price	£	s	d			
										Issues	7	0	0	0	£10	70	0	0
Dugdale Iron Co. ..										do.	5	0	0	0	"	50	0	0
Consett Iron Co. ..										do.	6	0	0	0	£9 10s	57	0	0
										do.	10	0	0	0	£10	5	0	0
										Stock carried forward	10	0	0	0	"	100	0	0
											28	10	0	0	£282	0	0	
										</								

ASBESTOS MILLBOARD.										Cr.
Dr.	Baxendale & Allen ..	2 0 0	28/-	2 16 0	Issues do. Stock carried forward ..	1 0 0 2 0 0 2 0 0	28/- " "	1 8 0 0 14 0 0 14 0		
		2 0 0		£2 16 0		2 0 0		£2 16 0		
	Stock brought forward ..	2 0 0	28/-	0 14 0						

(if it were so extracted) between the storekeeper's own Received and Issued Books. The greatest value of this Ledger probably arises in connection with yard management, as it enables the manager to so arrange the ordering of goods for contracts in progress that there may be no delay through waiting for material; but it will also be perceived that it constitutes a valuable check upon the honesty of the Stores Department. If at stocktaking there is any deficiency in values taken at invoice price, the comparison of the Stock Sheets and Stores Ledger will show in what goods the deficiency arises, and what quantities are missing. Further than this, it will prevent the storekeeper from hiding a deficiency in one class of goods by an excess in some other goods.

There is considerable difficulty in describing parts of machines by words and figures which will sufficiently identify them, and various devices have been adopted by Engineers for shortening the descriptions without detracting from their technical use. Perhaps one of the best methods is that of the Ferracute Machine Co., Bridgeton, N.J., a very complete description of which is reprinted in the first edition of Messrs. Garcke and Fells' "Factory Accounts." The idea is to give to each machine a symbol of three letters, the first two being indicative of the character of the machine, and the third of its size, thus:—F.P.A. is the symbol for a force pump of the smallest size made. This, however, only symbolises the complete machine, but a machine consists of numerous parts, and therefore a number is connected with the symbol; thus, T.P.L.-1 means the frame of a No. 3 treadle press. The convenience and brevity of this method can be perceived from one example—namely, a 6" × 4' engine lathe spindle head is represented by E.L.A.-4. These symbols are selected by the designer of the machine, and a Symbol Book is kept in the Drawing Office. Particulars are furnished to the bookkeepers

for the purposes of their accounts, and also to the various technical officers of the yard.

In a Ship-yard, the divisions into details are more numerous, and in some cases more minute, than in a Machine-making Engineer's Factory. The ship is the unit, so far as the contract price is concerned; but, on the other hand, it is the accumulation of many structures, extensive in bulk and vastly expensive, the separate cost of which it is necessary to compute. On looking over a specification for an ordinary merchant ship, it will be found that there are clauses defining the size and description of keel, stem, and stern-post, frames, plating and rivetting, the watertight bulkheads, main deck, spar deck, ceiling, and bulwarks, which are the mere frame of the ship, in addition to clauses relating to engines, boilers, cabins, saloons, lights, boats, anchors, and outfit generally; and it is essential for the purposes of Cost Accounts that the charges against these various details should be specified in the Stores Books and in the Wages Sheets. No complete system of symbols has been adopted by Shipbuilders similar to that of the Ferracute Company, but in general the charges are made against (*e.g.*) "Contract No. — saloon." These details in subsidiary books do not pass into the financial books of the firm, but are necessary for the Cost Accounts hereinafter described.

CHAPTER III.

SALARIES AND WAGES.

IN Ship-yards more especially, but also in some Tool-making or Engine-making Shops, a large proportion of the wages is paid at agreed piece rates, and the Wages Sheets are therefore not made up on the actual time worked; but in order to ensure uniformity of practice in the yard, and to avoid any laxity on the part of subordinate officers, it is desirable that all time actually worked in the yard should be recorded. This is usually done by means of a Time Book kept at the gate, which is compiled from the men's tickets as they pass in or out of the yard, or from a self-acting time recorder, which serves the same purpose. The Wages Sheets, however, cannot be prepared from this book, so far as money is concerned; but it will be used to insert, or to check, the time which has been worked.

The authority for the commencement of any work in the shops is a document generally issued from the Drawing Office, and which is technically termed a "Shop Order." It gives the consecutive number of the order, as received by the firm, the particulars of the machine, particulars of the drawings, the parts to be supplied from Stores or other makers, and the patterns which are required. From this authority the foreman of any department will set such men as are necessary to work on various portions of the order, marking on their time tickets the number of the order and the symbol number, as already described, thus: $\frac{5746}{\text{M.M.B.}-6}$. There is always a quantity of work done for the general purposes of the firm, which does not usually

bear any order number—such as small repairs of buildings, or minor repairs of machinery, cleaning of yard, assistance to storekeeper, and labour of this kind. The particulars of this must be set out on the workmen's tickets in such a manner as to distinguish its character and the particular building upon which it is done.

In Shipbuilding Yards, where repair work is done, it is desirable to detail, when possible, the particular portions of work upon which each man is engaged, thus:—

- Drilling out rivets.
- Removing old plates.
- Cutting new plates.
- Drilling new plates.
- Rivetting up new plates.
- Caulking.
- Painting.

This, however, is not always practicable, as much of this work is done under great pressure, working late into the night, and with imperfect supervision from the foreman; but it is absolutely necessary that the name of the ship under repair should be specified on each man's ticket.

The day rates paid to the men are recorded in a book usually kept in the office of the works manager, and are advised by him to the timekeeper. These rates must be checked with the Wages Book, so that no alteration may be made in the amounts paid, without proper authority. A similar book is kept for piece-work rates, which are agreed upon between the works manager and the men before the job is commenced, except in the numerous cases where similar work has been done before in the shop, when the same rates are usually adopted. A form of Wages Book is given in Specimen Nos. 10 and 11.

The first column is for the number given to the men on entering the yard, and corresponds with the number on his time ticket; these numbers are arranged so that each trade shall be together, a sufficiency of spare numbers being left between each description of workmen; as, for instance, between moulders and machine men; and, again, between machine men and fitters. The second column is for the names of the men; the third column is headed "Process." By "Process" is meant the sub-divisions of a contract or job, as distinguished from the total contract or job. As we have already explained, whilst T.P.L. is a treadle or foot press, T.P.L.-1 is a frame of such press, and the latter symbol, as well as the word "frame," indicates what is meant by process. This sub-division into processes is chiefly necessary for the purposes of detailed Cost Accounts. Next comes the time worked, with columns for each day, and a column for the total of the week. After that, the rate and the wages per process to each man. The last column shows the amount payable to each man in one sum, although it may frequently happen that he is employed on two or three different jobs in the course of the week. Specimen No. 11 shows the manner in which piece work is dealt with through the Wages Book. John Jones has had a piece of work let to him to complete for the price of £6 5s. 8d., and he is three weeks in doing it. During the first week he has been at work six days, and his total time is entered, and no rate placed against it; but on the next line is written, "On account of piece-work, £2," which he has to be paid. The second week there will be a similar entry; the third week he has finished the work, and, as a memorandum under his name shows, he is entitled to £6 5s. 8d., less £4 paid on account, therefore £2 5s. 8d. is extended for payment to him. In many Ship-yards, where cargo boat work is under construction, and where, to reduce cost, it is desirable to stimulate the men to increased exertion, a large portion of the work is frequently taken by a leading plater or rivetter on piece-work terms, he providing his mates, and dividing the earnings with them on terms which they

themselves agree to. In such cases it is expedient to open an account in the Ledger with the sub-contractor, and to debit this account with the various weekly payments made to him and to his mates. When the contract is completed this Ledger Account will be credited with the amount thereof, less any deductions for inferior or incomplete work; and finally balanced by the amount paid him through the Cash Book or Wages Book.

Unpaid Wages—that is to say, wages not applied for by the men at pay time—should be picked off the boards by the cashier, and the men's numbers and amounts entered in a small memorandum book. Most of these amounts will be applied for the following day, but if from any cause they are not applied for up to the annual stocktaking, then they should be brought to debit in the Cash Account as "Cash received from unpaid wages," and credited to the account to which they had originally been charged, say, in an ordinary Engineering Works, to Manufacturing Account; in a Ship-yard to Contract No. —, or No. —, or to Repairs of steamship CONUNDRUM.

It will be generally found convenient to make a separate total in the Wages Book for each department therein, and at the end a summary of the whole of the departments, the total of which must agree with the wages paid for the week by the cashier, including, of course, the amounts which he has picked up as unapplied for. But in the nominal accounts of the firm, as will be seen later, the wages are not posted to accounts headed for particular workmen or particular departments, but are transferred from a Wages Account (which is debited with the total wages for the week) to various Expenses Accounts, which correspond to some extent with the Invoice Book—such as New Machinery, Building Repairs, Manufacturing Account, or Contract No. —. An abstract in the Wages Book has therefore to be made, and this is most conveniently prepared on large sheets of paper ruled with perpendicular lines, as in Specimen No. 12. The space marked "A" is for the order

numbers, or, in a Ship-yard, for the number or total of the contract; that marked "B" is for the symbol, name, or other designation of the process. In Shipbuilding these abstracts will at times become somewhat voluminous, as at certain stages in the progress of a ship—that is, just before her launch, and generally before her trial trip—men are employed on a considerable number of different details at the same time. This complexity is, however, reduced when the abstract is made—as it should be made—each week. The abstract must be compiled by trades. Each man's pay, as it appears in the Wages per Process column, must be entered separately in the abstract, an addition being made at the foot of each department. The totals of the various columns will agree with the total payment to the class of workman which appears in the Wages Book, and the total of all the sheets of the abstract for the week will agree with the weekly total of the Wages Book; to ensure accuracy, it is desirable to have this abstract checked, so that a charge may not go against a wrong job of work.

The office staff, draughtsmen, foremen, storekeeper, works manager, and other officers of the company are usually paid monthly salaries, and the totals of such salaries will appear in the Cash Book, and be posted to the debit of "Salary Account" in the Ledger. For Cost Account purposes, however, it is necessary, in a Shipbuilding Yard, to keep a record of the special work on which foremen are employed. Possibly, there may be three or four foremen of shipwrights in such an establishment, each of whom will be assigned the supervision of a particular ship then in construction, and in general it is necessary to charge his salary to that particular ship, and not to management expenses. In the Trade Account of the firm, however, it is not desirable to make such a division, as, for purposes of comparison between one period and another, it is better to leave the permanent staff undistributed.

CHAPTER IV.

MANUFACTURED GOODS AND CONTRACTS.

THE consummation of the unity of materials and labour is finished product. This must be considered in three aspects, namely:—

Large contracts.

Smaller orders and repairs.

Machinery, &c., for stock purposes.

We will take the consideration of them in this order.

The best example for account purposes of a large contract is an ocean-going ship, as such vessels are usually paid for by instalments on the completion of certain stipulated work, and perhaps a war ship is even more instructive than an ordinary merchant ship. The following are the conditions upon which the British Admiralty contracted to pay for a composite gun vessel built for the Royal Navy. She was built with steel frames and reverse frames, planked with teak, and had decks laid with crown deals.

First instalment: Payable when two-thirds of the frames and the reverse frames are in place.

Second: When the whole of the frames are in place, and half of the bottom planking is on the builder's premises.

Third: When the beams are in place, and three-quarters of the deck stringers and sheer strakes worked, and deck deals on the premises.

Fourth: When the whole of the deck stringers and sheer strakes are worked, and all teak and other planking on the premises.

Fifth: When the whole inside of bottom planking is worked, and a half of the outer thickness of planking also worked.

Sixth: When the whole of the outside planking is worked and caulked, three-quarters of the deck laid, three-quarters of the inside lining fitted, and the principal forgings one-half completed.

Seventh: When all the decks are laid, and the vessel in a fit state to receive engines and be launched.

Eighth: When engines are on board, the decks shut in and caulked, and half the cabin framing in place.

Ninth and final instalment: Payable when the ship had completed her trial trip, and been accepted by the Admiralty as satisfactory.

A separate contract was made with another firm for the engines, the payment for which was likewise divided into nine instalments.

In this particular instance special difficulties arose, partly from obtaining some of the material, and partly in consequence of alterations made in the plans by the Admiralty constructors after the ship was in progress, and she was therefore about two years in building, and the instalments were earned somewhat irregularly; but no similar ship would be constructed under the most favourable circumstances in less than ten or twelve months, whilst fifteen to eighteen months would not be an unreasonable time. It is therefore evident that such ships will usually extend over more than one period of account, and the contract price cannot be credited to Trade Account in one sum.

Where the terms of payment are so precisely laid down as in this case, and the progress of the work can be so definitely determined, it is best to bring to credit each instalment as it is earned. This leaves the estimate for work in progress at stock-taking much smaller, and in every respect less difficult, than if the whole of the contract were estimated as "work in progress"; and it may be remembered that there is no more fruitful source of error in a Shipbuilding or large Engineering Works than the estimate of the value of work in progress.

In other cases, where the work is of a comparatively simple description and easily measured, the payment will be made by instalments during progress on certificates of work executed, and these certificates should be credited to Trade Account in the same manner as the defined instalments of the ship. This is particularly applicable to caisson work in a Ship-yard, and to bridge and heavy crane work in a General Engineering establishment. As, however, in such measurement certificates the same weight of metal passes through two or three degrees of payment, such as

Plates and angles on the premises,

Plates and angles drilled and erected,

Plates and angles rivetted in place,

great care must be taken that it is not included twice at stock-taking time in any estimate which is made of work in progress.

In Ship-yards and in Engineering establishments where only large contract work is executed, the ordinary Journal may be the most convenient form for these entries, but in General Engineering establishments, as referred to in the next paragraphs, a Day Book, or a book analogous to a Day Book, must be employed.

Smaller orders, for such things as gas engines, lathes, spinning-jennies, looms, dynamos, steam hammers, &c., &c., are usually given upon a fixed and agreed price. The construction of these machines does not, however, extend over a very long period, and the payments for them are usually made on, or after, delivery, and not by instalments, as for ships or marine engines, excepting under special circumstances, generally conditional on the stability of either the manufacturer or purchasing firm. They will, therefore, be debited to the purchaser and credited to Trade Account on delivery, and, as such transactions are numerous in establishments producing work of this character, a Day Book is the most convenient form for the pur-

Specimen No. 13.—

DAY BOOK.

	£	s	d	£	s	d
The Normanton Engineering Company, Limited :—						
Horizontal Surface Condensing Engine to Specification	1,900	0	0			
Extra Wheel for Rope driving	95	0	0			
				1,995	0	0
Silkstone Colliery Company, Limited :—						
Repairs to Pumping Engine	874	0	0			
Repairs to Winding Machinery	172	0	0			
				1,046	0	0
Wheatstone Spinning Company, Limited :—						
Supplying and Fitting overhead Shafting for Wheatstone Mill	396	0	0			
Extra Pulleys	50	0	0			
				446	0	0

pose. Somewhat similar in character is the repair work done to stationary engines and machinery, the price of which work is very frequently fixed before it is undertaken, but the payment for which is not made before the completion of the job. These debits also pass through the Day Book. The estimate of value of work in progress at stocktaking is less difficult for these

small orders and repairs than it is for large and complicated ocean-going steamers; but the difficulty is only less when each item of work is separately estimated, and not when a lump sum is taken for all the work which may be in progress in the yard.

The technical particulars given in an Engineering invoice are numerous, and an invoice for repairs especially is a lengthy and highly technical document. It will therefore save time to take press copies in a Letter Book of the invoices actually rendered, and in the Day Book to enter only the name of the customer, the page of the Letter Book, the amount, and any particulars which may be needful for posting or for identifying the entry. The Day Book totals will, of course, be credited to a Sales Account in the Nominal Ledger.

When a merchant business is done by any manufacturing firm, and when goods are made in the factory to be stocked and afterwards sold from Stock, it is needful to open a Warehouse Account for them, and for the warehouseman to keep a set of books in the same manner as the storekeeper does for his goods. Specimens 14, 15, and 16 give examples of "Warehouse Received Book, "Warehouse Issue Book," and Warehouse Ledger.

Specimen No. 14.—

WAREHOUSE RECEIVED BOOK.

Date	Description of Goods	Catalogue No.	Marks	

Specimen.—No. 15.**WAREHOUSE ISSUED BOOK.**

Date	Description of Goods	Catalogue No.	Marks	To whom Delivered	Particulars of Packing

Specimen No. 16.—**WAREHOUSE LEDGER.**

Description.—Screw Cutting Lathes.—Catalogue No. 47. Marks....

Date Received	Number	Journal Folio	Date Delivered	To whom Delivered	Number	Consignee's Marks	Day Book Folio

It will be observed that no money columns are inserted in these warehouse books. There is a reason for this, which, though it may not be universally applicable, it is certainly desirable to remember in the case of small firms employing, say, two or three hundred men only. If the articles are debited to the warehouseman at, or near, the actual cost of manufacture, he will ascertain the approximate amount of Gross Profit made on each of them—knowledge which it is most

desirable should be unknown to subordinate officers of smaller firms. If, on the other hand, the goods are debited to him at the selling price, there is grave danger of an over-valuation of the Stock in the warehouse at the time of stocktaking. It is, therefore, better to make the money transfers in the General Office Books only. In these books the sequence of the entries will be a charge in the Day Book to Warehouse Account for goods delivered to the warehouseman ready for immediate sale, which will be posted in the Ledger to the debit of Warehouse Account, and be included in the total credited to Sales Account exactly the same as if they had been delivered to a customer, but, of course, at a lower price than would be charged to the customer. In the General Office a Warehouse Day Book (Specimen No. 17) must be kept, and the various entries therein posted to the debit of the several customers, and the total to the credit of Warehouse Account.

Specimen No. 17.—

WAREHOUSE DAY BOOK.

Date	Name	Amount
		£ s d

The price at which goods shall be transferred from the Manufacturing Department to the Warehouse or Retailing Department is rather a matter of financial management than of account, and will be found discussed in the author's work on "The Commercial Management of Engineering Works," page 262, &c.

Just in the same way as the Manufacturing Engineer returns to previous manufacturers imperfect or unsuitable goods, so he will have returned to him by his customers machines and other articles which in some way or other do not correspond with his representations or specification; and these returned goods have to be recorded in the books. These books will be similar both for goods returned into warehouse stock (having originally come from such stock), and for goods returned into stores from contracts or repairs, which have not passed through the warehouse in the first instance. Specimen No. 18 will show the

Specimen No. 18.—**CREDITS TO CUSTOMERS BOOK.**

	£	s	d	£	s	d
Dennison, Barlow & Co.—						
Two Wrought Iron Clutches returned as defective from Dynamo No..... ..	60	0	0			
Allowance agreed to for defective Winding	30	0	0			
Debit Manufacturing Account ... ..	..			£90	0	0
Balfour, Winton & Jones—						
One Slotting Machine, No....., returned—delivered late for shipment .. ..	..	..		£120	0	0
Debit Warehouse Account .. ..	..				

method of keeping these books. The monthly totals will be entered in the General Ledger to the debits of Stores Account and Warehouse Account respectively, and individual items will be posted to the debit of the several accounts affected by them in the Stores and Warehouse Books in exactly the same manner as if they had been received from some outside manufacturer.

CHAPTER V.

CASH BOOK, DEPRECIATION, ESTABLISHMENT CHARGES, AND SUNDRY NOMINAL ACCOUNTS.

THE Cash Book should be of the ordinary simple description; any columnar form will probably be troublesome, and lead to complications in an Engineering establishment. There are, however, numerous payments which will have to be posted direct to Expenditure Accounts, and not to the debit to any person, as no corresponding credits will be raised through the Invoice Book. Of this character are payments for travelling expenses, for certain office expenses, for directors' fees, and for petty cash expenditure. The Cash Book should be relieved of details of the latter expenditure by means of the Petty Cash Book, but this must be analysed and brought into the Cash Book each month. A note of the character of these direct payments must be made in the Cash Book, so that there may be no difficulty in posting them to the proper accounts, nor any subsequent trouble in extending them without turning up the vouchers. For instance, a payment of £30 is made to John Jones for commission on an order obtained by him, but instead of simply entering the name John Jones, £30, the entry should be, John Jones, Commission, Order number 3,421, £30. The same applies to travelling expenses, but as such expenses are differently treated in the Cost Accounts when they are undertaken on behalf of a specific contract, and when they are on the general and undefined business of the company, a short note of the service should be entered in the Cash Book. In the example given no banking account is introduced, but it is better in practice to use a third column for this purpose.

Specimen No. 19.

Dr.

CASH BOOK.

Cr.

Dr.	£	s	d	£	s	d	Cr.
To Cyclops Manufacturing Co. on Account of Contract No. 3431 .. .. .	..	..	..	By Lloyd & Lloyd ..	..	..	Cash £ s d 92 5 0
" Edward Sampson & Co., Lim. .. .. .	..	..	..	" Dugdale Iron Co. ..	..	..	519 13 0
" Samuel Jones, Pearce & Co., Lim., on Account of Contract No. 3430 .. ..	..	..	..	" Richardson & Woollan ..	..	..	174 0 0
" Robert Lowe .. ..	..	..	..	" R. Astor & Co. ..	..	..	86 0 0
	..	..	..	" E. Bridgeford ..	12 0 0	0 0	228 0 0
	..	..	..	" American Machinery Trust .. .. .	..	..	30 0 0
	..	..	..	" Scott & Fairfield ..	..	..	29 0 0
	..	..	..	" Jones & Simons ..	..	..	11 0 0
	..	..	..	" Dudley Coal Co. ..	1 11 0	0 0	29 9 0
	..	..	..	" London & N. W. Railway	..	..	174 0 0
	..	..	..	" Milne, Smith & Co. ..	..	..	42 0 0
	..	..	..	" Wyneside Corporation ..	7 6 0	0 0	138 14 0
	..	..	..	" Salaries .. .. .	..	..	41 0 0
	..	..	..	" John Jones, Commission on Order 3421 .. ..	..	..	100 0 0
	..	..	..	" Petty Cash—	..	..	30 0 0
	..	..	..	Stamps	£2 10 0	0 0	
	..	..	..	Travelling Expenses } ..	9 11 0	0 0	
	..	..	..	Directors' Fees .. ..	..	..	12 1 0
	..	..	..	" Balance Carried Forward	..	..	50 0 0
	..	..	..		..	..	90 8 0
	£1,877	10	0		£53	1 0	£1,877 10 0

Depreciation is one of the most difficult problems of Engineering Accounts, and materially affects the ultimate result of the Profit and Loss Account. There are two methods in vogue: the first, and most usual one, is that of writing off a fixed percentage from a decreasing value for buildings, fixed machinery, and loose plant; and the other is reducing the cost of these items by a fixed yearly sum, which will, in a determined number of years, extinguish them. The determination of the method to be adopted rests with the directors and other technical advisers, as it involves questions much wider than those of mere account, and which can only be properly appreciated by Engineers practically acquainted with the machines, and constantly watching the improvements made both in the particular machinery and in other allied departments of Engineering. The author is of opinion that in the present condition of Engineering, and the restless activity which impels Engineers to constant and rapid improvements of machinery, and the introduction of labour-saving devices, it is better to fix the life of each machine, and to calculate the depreciation on such by an equal annual amount, which will extinguish the cost at the end of the estimated period. The question has been fully discussed in the treatise on "Commercial Management," previously referred to. Where the percentage method is adopted it is certainly advisable to divide the buildings and machinery into several classes, and to vary the rate of depreciation according to the character of these classes. One firm, whose managing director has a most extensive acquaintance with workshop finance, divides its plant into six classes, the depreciation on which ranges from 5 per cent. to 22 per cent. per annum. There is, however, one objection to this arrangement from an accountant's point of view, which can be more readily obviated when the Depreciation is calculated for each machine separately. If it is made up of classes, a double classification will be needful in order that the Cost

Accounts may be debited with the Depreciation of each department. First, a classification will have to be made by shops or departments; and, secondly, by classes within those shops, and the anticipated saving in trouble will thus be reduced to a minimum. When a machine is removed from one place to another, a fresh calculation will be necessary to adjust the balance in both departments, and if two or three such removals are made in any one year the alterations will probably prove perplexing.

Whatever method is adopted for depreciating the buildings and plant, a schedule of the machines in each building, and in charge of each department therein, should certainly be kept, but this schedule should be prepared by the technical officers of the company, in order to be of real value, and it is undesirable therefore to give any form for it.

The question of Depreciation becomes a particularly involved one when loose tools are concerned, and this is more especially the case in Ship-yards, because close supervision is more difficult in such establishments than in closely-confined and self-contained factories. In future, this question is likely to become even more serious than at the present time, since small electrically-driven tools, which can be readily moved from place to place, are being largely introduced. In the first instance, the majority of these articles are purchased and delivered into stores, and are issued by the storekeeper on the requisitions of the various foremen as they may be from time to time required. They are subject to attrition, to loss through carelessness, and also to loss through larceny, and certainly no such rate as 5 per cent., or even 10 per cent., per annum will be sufficient to cover the wastage. It is, however, quite impossible to keep an individual record of these articles, and there is no alternative but to adopt an average rate or rates. The issues may be divided into classes, the character of these classes and the percentage

for each being determined by the technical officers. The balance at stocktaking will never be the exact balance of Loose Tools Account, but, if there is any considerable discrepancy, it should be carefully enquired into. If it arises through an improper percentage having been written off, this should be corrected in future accounts; but if from careless or destructive usage, the technical officers should probe the matter to the bottom, so that it may be remedied in future periods. It is convenient to keep a record of loose tools in greater detail than can be done in the Ledger of the firm, and probably the form given in Specimen No. 20 will be suitable for most Engineering Works. The author has adopted it from the establishment of an Electrical Engineer, but introduced some features which will, he thinks, make it an improvement on the original.

Specimen No. 20.—**SCHEDULE OF LOOSE TOOLS IN CHARGE OF FITTERS.****DEPARTMENT.—CLASS A.**

Date	No.	Particulars	Price	Amount
January		Balance and Issues (to be detailed) .. ..	..	£ s d 150 6 4
		Less Depreciation 2% .. ..	..	3 0 3
February		Issues (to be detailed) .. ..	..	147 6 1
				20 6 8
		Less Depreciation 2% .. ..	..	167 12 9
				3 4 3
		(And so on.)		164 8 6

DEPARTMENT.—CLASS B.

Date	No.	Particulars	Price	Amount
January		Balance and Issues (to be detailed) .. ..	..	£ s d 200 0 0
		Less Depreciation 1% .. ..	..	2 0 0
February		Issues (to be detailed) .. ..	..	198 0 0
				37 10 0
		Less Depreciation 1% .. ..	..	235 10 0
				2 7 1
		(And so on.)		233 2 11

CHAPTER VI.

LEDGER, TRADE ACCOUNT, BALANCE SHEET, AND AUDIT.

THE various details given in the books previously considered have to be collected into a summary form convenient for reference. This is done by means of the Ledger, which is really a synthetical index to these subsidiary books, and which, in balancing, proves the correct summarising of the numerous debits and credits which they contain. It must, however, be remembered that balancing only proves correct summarising; it affords no guarantee of the propriety of the original entries, nor any assurance that they have been posted to the proper Nominal or Personal Accounts. Errors in Personal Accounts are usually detected and rectified when payments are made; but in the businesses of the Mechanical Engineer or Shipbuilder, the Nominal Accounts are more frequently referred to, and used more generally for financial purposes than they are in a purely merchant business, or even in the textile trades, and any errors in them may prove very misleading in the management of the works.

In a General Engineer's factory separate accounts should always be opened for

- Land;
- Buildings;
- Engines, Boilers, and Economisers;
- Fixed Machinery;
- Shafting;
- Loose Plant and Tools;
- Patterns.

This is necessary in order that the expenditure under these several heads may be known, and also in order that Depreciation may be properly adjusted. In Ship-yards it is also desirable to open accounts in addition for

Piling under Launchways,

Blocks and Timber for Launching.

The timber actually consumed in the launch of any ship can be approximately ascertained when the launch is over, and should be charged to the cost of that individual contract.

Electricity is being largely substituted for steam and gas engines as a motive power, and this substitution will be in progress for many years to come. In works where this transition is taking place it is desirable to open Ledger Accounts for

Electric Dynamos,

Electric Wiring,

Electric Motors.

Depreciation of this form of power transmission is certainly more rapid than in the older forms, but so little is yet accurately known of the actual wear and tear, or of the methods of mitigating it, that no reliable percentage can be fixed upon. It would, however, be most misleading to class electrical machinery with other machinery, at all events in the permanent records of the firm, even if it is grouped together in the published Balance Sheet.

The following examples (Specimen No. 21) will explain the compilation of the ordinary Nominal Ledger Accounts, and the Trade Account and Balance Sheet (Specimens Nos. 22 and 23) their final consummation. The Journal (Specimen No. 24) is in most modern establishments wisely restricted to final transfer entries, and for such adjustments as do not arise in any of the subsidiary books. The examples given are only of this nature.

LEDGER

Specimen No. 21.

<i>Dr.</i>		SHARE	

<i>Dr.</i>		RESERVE	

<i>Dr.</i>		FREEHOLD	
	To Freehold Land for Works purchased as per Agree- ment for Incorporation of Company	£ s d ..	£ s d 2,000 0 0 <u>£2,000 0 0</u>

<i>Dr.</i>		FREEHOLD	
1902 Jan. 1	To Balance brought forward, being value of Buildings at date	£ s d ..	£ s d 1,500 0 0 <u>£1,500 0 0</u>
1903 Jan. 1	To Balance	£ s d ..	£ s d 1,425 0 0

ACCOUNTS.**CAPITAL.***Cr.*

		£	s	d	£	s	d
	By 1,500 Ordinary Shares of £10 each fully paid .. ..	..			15,000	0	0
	„ 1,000 Preferred 5 per cent. Shares of £10 each fully paid .. .. .	..			10,000	0	0
				£	25,000	0	0

FUND.*Cr.*

		£	s	d	£	s	d
1900 Dec. 31	By Amount transferred from Profit and Loss Account .	..			1,500	0	0
1901 Dec. 31	„ Do. do. ..	..			1,500	0	0
					£3,000	0	0

LAND.*Cr.*

BUILDINGS.*Cr.*

		£	s	d	£	s	d
1902 Dec. 31	By Profit and Loss Account for Depreciation at 5 per cent.	..			75	0	0
	„ Balance .. .. .	..			1,425	0	0
					£1,500	0	0

Dr.

MACHINERY

		£	s	d	£	s	d
1902							
Jan. 1	To Balance brought forward, being value of Machinery and Plant at date .. ..	..	..	..	11,721	0	0
Dec. 31	„ Additions per Invoice Book ..	..	..	..	279	0	0
					£12,000	0	0
1903							
Jan. 1	To Balance .. .. .	..	..	..	11,400	0	0

Dr.

PATTERNS

		£	s	d	£	s	d
1902							
Jan. 1	To Balance brought forward, being value of Patterns at date .. .. .	..	..	..	1,400	0	0
Dec. 31	„ Pattern-making Account for additions .. .. .	..	..	..	100	0	0
					£1,500	0	0
1903							
Jan. 1	To Balance .. .. .	..	..	..	1,350	0	0

Dr.

RENT, RATES,

		£	s	d
1902				
Jan. 31	To Sundries, per Invoice Book ..	..	..	44 0 0
Mar. 31	„ Do. do. ..	..	..	171 0 0
June 30	„ Do. do. ..	..	..	44 0 0
Dec. 31	„ Do. do. ..	..	..	162 1 6
	„ Evan Daniel, Cash ..	..	..	41 1 10
				£462 3 4

Dr.

GAS AND

		£	s	d	£	s	d
1902							
Jan. 31	To Sundries, per Invoice Book ..	..	..	..	27	0	0
June 30	„ Do. do. ..	..	..	..	85	6	0
Dec. 31	„ Do. do. ..	..	..	..	85	0	0
					£197	6	0

AND PLANT.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Profit and Loss Account for Depreciation at 5 per cent.	..			600	0	0
	.. Balance .. .. .	..			11,400	0	0
					<u>£12,000</u>	<u>0</u>	<u>0</u>

ACCOUNT.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Profit and Loss Account for Depreciation at 10 per cent.	..			150	0	0
	.. Balance .. .. .	..			1,350	0	0
					<u>£1,500</u>	<u>0</u>	<u>0</u>

AND TAXES.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Transfer to Trade Account ..	..			462	3	4
					<u>£462</u>	<u>3</u>	<u>4</u>

WATER.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Transfer to Trade Account ..	..			197	6	0
					<u>£197</u>	<u>6</u>	<u>0</u>

Dr.

INSURANCE

1902			£	s	d	£	s	d
Jan. 31	To Sundries, per Invoice Book ..	..	..			15	0	0
Dec. 31	" Do. do. ..	..	..			55	0	0
						<u>£70 0 0</u>		

Dr.

DISCOUNT

1902			£	s	d	£	s	d
Jan. 31	To Discounts Allowed ..	..	..			23	2	7
Feb. 28	" Do. ..	..	..			41	4	4
Mar. 31	" Do. ..	..	..			17	2	1
April 30	" Do. ..	..	..			39	1	2
May 31	" Do. ..	..	..			52	3	6
June 30	" Do. ..	..	..			74	5	1
July 31	" Do. ..	..	..			18	2	4
Aug. 31	" Do. ..	..	..			16	3	4
Sept. 30	" Do. ..	..	..			20	5	6
Oct. 31	" Do. ..	..	..			57	6	4
Nov. 30	" Do. ..	..	..			43	7	2
Dec. 31	" Do. ..	..	..			60	4	1
						<u>£462 7 6</u>		

Dr.

MANAGEMENT

1902			£	s	d	£	s	d
Jan. 31	To Cash—Sundries ..	..	..			100	0	0
Feb. 28	" Do. do. ..	..	..			100	0	0
Mar. 31	" Do. do. ..	..	..			100	0	0
April 30	" Do. do. ..	..	..			100	0	0
May 31	" Do. do. ..	..	..			100	0	0
June 30	" Do. do. ..	..	..			100	0	0
July 31	" Do. do. ..	..	..			100	0	0
Aug. 31	" Do. do. ..	..	..			100	0	0
Sept. 30	" Do. do. ..	..	..			100	0	0
Oct. 31	" Do. do. ..	..	..			100	0	0
Nov. 30	" Do. do. ..	..	..			100	0	0
Dec. 31	" Do. do. ..	..	..			100	0	0
						<u>£ 1,200 0 0</u>		

ACCOUNT.

Cr.

1902		£	s	d	£	s	d
Dec. 31	By Transfer to Trade Account ..	£	..		70	0	0
					£70	0	0

ACCOUNT.

Cr.

1902		£	s	d	£	s	d
Jan. 31	By Discounts Received .. ..	..			21	1	4
Feb. 28	" Do. .. ..	..			5	6	7
Mar. 31	" Do. .. ..	..			16	5	2
April 30	" Do. .. ..	..			27	0	9
May 31	" Do. .. ..	..			46	1	10
June 30	" Do. .. ..	..			54	0	1
July 31	" Do. .. ..	..			18	3	8
Aug. 31	" Do. .. ..	..			16	4	7
Sept. 30	" Do. .. ..	..			20	1	2
Oct. 31	" Do. .. ..	..			40	18	6
Nov. 30	" Do. .. ..	..			41	17	4
Dec. 31	" Do. .. ..	..			35	18	8
"	" Transfer to Trade Account ..	..			119	7	10
					£462	7	6

WAGES (OR SALARIES).

Cr.

1902		£	s	d	£	s	d
Dec. 31	By Transfer to Trade Account ..	£	..		1,200	0	0
					£1,200	0	0

WAGES.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Transfer to Trade Account ..	£	..		600	0	0
					<u>£600 0 0</u>		

EXPENSES.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Transfer to Trade Account ..	£	..		37	10	6
					<u>£37 10 6</u>		

ACCOUNT.

Cr.

		£	s	d	£	s	d
1902 Dec. 31	By Transfer to Trade Account ..	£	..		51	0	0
					<u>£51 0 0</u>		

<i>Dr.</i>					<i>ENGINE</i>		
1902					£	s	d
Jan. 31	To Sundries, per Invoice Book				..	121	0 0
Mar. 31	" Do. do. ..				..	50	0 0
April 30	" Do. do. ..				..	20	0 0
May 31	" Do. do. ..				..	48	0 0
July 31	" Do. do. ..				..	70	10 0
Oct. 31	" Do. do. ..				..	71	0 0
Dec. 31	" Do. do. ..				..	20	0 0
					<u>£400 10 0</u>		

<i>Dr.</i>					<i>RUNNING</i>		
1902					£	s	d
Jan. 31	To Wages Account	..	..		28	0	0
"	" Stores	"	"	..	9	7	4
Feb. 28	" Wages	"	"	..	28	0	0
"	" Stores	"	"	..	8	17	1
Mar. 31	" Wages	"	"	..	35	0	0
"	" Stores	"	"	..	12	1	6
April 30	" Wages	"	"	..	28	0	0
"	" Stores	"	"	..	7	3	2
May 31	" Wages	"	"	..	38	0	0
"	" Stores	"	"	..	8	10	0
June 30	" Wages	"	"	..	35	0	0
"	" Stores	"	"	..	15	11	6
July 31	" Wages	"	"	..	28	0	0
"	" Stores	"	"	..	9	7	4
Aug. 31	" Wages	"	"	..	28	0	0
"	" Stores	"	"	..	8	13	6
Sept. 30	" Wages	"	"	..	35	0	0
"	" Stores	"	"	..	6	1	10
Oct. 31	" Wages	"	"	..	38	0	0
"	" Stores	"	"	..	10	7	9
Nov. 30	" Wages	"	"	..	28	0	0
"	" Stores	"	"	..	14	6	0
Dec. 31	" Wages	"	"	..	35	0	0
"	" Stores	"	"	..	5	13	0
					<u>£500 0 0</u>		

Dr.

SMITHY

1902				£	s	d	£	s	d
Jan. 31	To Sundries, per Invoice Book..			..			53	0	0
Feb. 28	„ Do. do. ..			..			47	0	0
May 31	„ Do. do. ..			..			56	10	0
July 31	„ Do. do. ..			..			32	0	0
Aug. 31	„ Do. do. ..			..			40	10	0
Oct. 31	„ Do. do. ..			..			28	0	0
Nov. 30	„ Do. do. ..			..			43	0	0
							<u>£300 0 0</u>		

Dr.

CARTING

		£	s	d	£	s	d
To Sundries, per Invoice Book..		..			54	6	9
					<u>54 6 9</u>		

Dr.

RAILWAY

1902				£	s	d	£	s	d
Jan. 31	To Sundries, per Invoice Book..			..			42	0	0
Feb. 28	„ Do. do. ..			..			21	1	4
Mar. 31	„ Do. do. ..			..			8	7	6
„	„ Cash—Sutton & Co. ..			..			0	18	10
April 30	„ Sundries, per Invoice Book ..			..			23	4	8
May 31	„ Do. do. ..			..			16	4	7
June 30	„ Do. do. ..			..			25	2	6
July 31	„ Do. do. ..			..			4	1	2
„	„ Cash—Sutton & Co. ..			..			0	17	4
Aug. 31	„ Sundries, per Invoice Book ..			..			41	6	4
Sept. 30	„ Do. do. ..			..			6	1	0
Oct. 31	„ Do. do. ..			..			7	3	9
Nov. 30	„ Do. do. ..			..			1	16	1
Dec. 31	„ Do. do. ..			..			15	8	3
							<u>£213 13 4</u>		

61

Cr.

<div style="text-align: right; margin-bottom: 5px;">1902</div> <div>Dec. 31 By Transfer to Trade Account ..</div> <div>-</div>	£ s d ..	£ s d 300 0 0
		£300 0 0

Cr.

1902 Dec. 31	By Transfer to Trade Account ..	£ s d ..	£ s d 54 6 9
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Cr.

1902 Dec. 31	By Transfer to Trade Account ..	£ s d ..	£ s d 213 13 4
			£213 13 4

Dr.

MACHINERY

1902			£	s	d	£	s	d
Jan. 31	To Sundries, per Invoice Book ..	..	..	..	..	58	0	0
"	" Stores Account .. ..	..	..	..	..	16	7	6
"	" Wages .. ..	..	..	..	..	43	1	6
Feb. 28	" Stores .. ..	..	..	..	..	52	9	6
"	" Wages .. ..	..	..	..	..	116	9	4
Mar. 31	" Stores .. ..	..	..	..	..	1	4	3
"	" Wages .. ..	..	..	..	..	23	0	1
						<u>£310 12 2</u>		

Dr.

BUILDING

1902			£	s	d	£	s	d
Jan. 31	To Sundries per Invoice Book ..	..	..	..	..	31	0	0
"	" Stores Account .. ..	..	..	..	..	0	17	6
"	" Wages .. ..	..	..	..	..	74	9	10
June 30	" Stores .. ..	..	..	..	..	1	3	4
"	" Wages .. ..	..	..	..	..	37	2	8
Nov. 30	" Sundries, per Invoice Book ..	..	..	..	..	3	6	0
"	" Stores Account .. ..	..	..	..	..	2	1	6
"	" Wages .. ..	..	..	..	..	43	3	9
						<u>£193 4 7</u>		

REPAIRS.

Cr.

		£ s d	£ s d
1902 Dec. 31	By Transfer to Trade Account ..	..	310 12 2
			<u>£310 12 2</u>

REPAIRS.

Cr.

		£ s d	£ s d
1902 Dec. 31	By Transfer to Trade Account ..	..	193 4 7
			<u>£193 4 7</u>

Dr.		PATTERN MAKING									
1902											
Jan.	31	To Timber Account	..	..	£	s	d	£	s	d	
"	"	" Wages	"	..	0	17	6				
					37	10	0	38	7	6	
Feb.	28	" Timber	"	..	1	4	0				
"	"	" Wages	"	..	43	0	0				
"	"	" Stores	"	..	0	3	6	44	7	6	
Mar.	31	" Do.	"	..	0	18	0				
"	"	" Timber	"	..	1	10	0				
"	"	" Wages	"	..	43	0	0	45	8	0	
April	30	" Timber	"	..	1	10	0				
"	"	" Wages	"	..	43	0	0	44	10	0	
May	31	" Timber	"	..	2	10	0				
"	"	" Stores	"	..	1	3	6				
"	"	" Wages	"	..	43	0	0	46	13	6	
June	30	" Timber	"	..	2	0	0				
"	"	" Stores	"	..	0	18	6				
"	"	" Wages	"	..	45	0	0	47	18	6	
July	31	" Timber	"	..	2	10	0				
"	"	" Wages	"	..	34	0	0	36	10	0	
Aug.	31	" Wages	"	..	..			27	0	0	
Sept.	30	" Timber	"	..	1	0	0				
"	"	" Stores	"	..	2	0	0				
"	"	" Wages	"	..	27	0	0	30	0	0	
Oct.	31	" Wages	"	..	..			23	0	0	
Nov.	30	" Stores	"	..	1	8	7				
"	"	" Timber	"	..	1	10	0				
"	"	" Wages	"	..	54	10	0	57	8	7	
Dec.	31	" Wages	"	..	..			40	0	0	
								£481	3	7	

ACCOUNT.

Cr.

1902 Dec. 31		£ s d	£ s d
	By Transfer to Patterns Account for Estimated Value of additions to Patterns ..	..	100 0 0
	„ Transfer to Trade Account ..	..	381 3 7
			<u>£481 3 7</u>

<i>Dr.</i>		MANUFACTURING									
1902											
						£	s	d	£	s	d
Jan.	31	To Stores Account				1,472	13	7			
"	"	" Wages				1,412	4	0			
"	"	" Sundries, per Invoice Book ..				92	0	0			
Feb.	28	" Stores Account				1,424	9	6	2,976	17	7
"	"	" Wages				1,413	2	0			
Mar.	31	" Stores				1,316	10	1	2,837	11	6
"	"	" Wages				1,415	3	0			
April	30	" Stores				1,562	7	4	2,731	13	1
"	"	" Wages				1,420	6	0			
May	31	" Stores				1,517	3	10	2,982	13	4
"	"	" Wages				1,418	7	6			
June	30	" Stores				1,320	2	9	2,935	11	4
"	"	" Wages				1,301	6	0			
July	31	" Stores				1,721	3	7	2,621	8	9
"	"	" Wages				1,501	2	0			
Aug.	31	" Stores				1,476	8	6	3,222	5	7
"	"	" Wages				1,419	5	0			
"	"	" Sundries, per Invoice Book ..				400	0	0			
Sept.	30	" Stores Account				1,500	3	5	3,295	13	6
"	"	" Wages				1,418	6	0			
Oct.	31	" Stores				1,397	10	1	2,918	9	5
"	"	" Wages				1,413	4	0			
Nov.	30	" Stores				1,796	3	2	2,810	14	1
"	"	" Wages				1,423	5	0			
Dec.	31	" Stores				1,416	0	1	3,219	8	2
"	"	" Wages				1,002	0	0			
									2,418	0	1
									£	34,970	6 5

ACCOUNT.

Cr.

		£	s	d	£	s	d
1902							
Dec.	31	By Transfer to Trade Account ..			34,970	6	5
					<u>£34,970 6 5</u>		

ACCOUNT.

Cr

1902			£	s	d	£	s	d
Jan. 31	By Sales and Contracts, per Day							
	Book .. .. .		..			2,417	6	0
Feb. 28	.. Do. do. ..		..			2,318	10	0
Mar. 31	.. Do. do. ..		..			3,900	15	6
April 30	.. Do. do. ..		..			3,807	4	6
May 31	.. Do. do. ..		..			3,164	0	0
June 30	.. Do. do. ..		..			3,007	15	0
July 31	.. Do. do. ..		..			2,870	16	2
Aug. 31	.. Do. do. ..		..			4,000	19	0
Sept. 30	.. Do. do. ..		..			3,110	4	0
Oct. 31	.. Do. do. ..		..			1,937	10	0
Nov. 30	.. Do. do. ..		..			3,502	2	0
Dec. 31	.. Lo. do. ..		..			1,516	9	0
						£	35,553	11 2

ACCOUNT.

Cr.

1902			£	s	d	£	s	d
Jan. 31	By Sundries—Issues	.. ..	..			1,500	3	5
Feb. 28	.. Do. do. ..		..			1,487	3	7
Mar. 31	.. Do. do. ..		..			1,332	3	10
April 30	.. Do. do. ..		..			1,571	0	6
May 31	.. Do. do. ..		..			1,529	7	4
June 30	.. Do. do. ..		..			1,339	16	1
July 31	.. Do. do. ..		..			1,733	0	11
Aug. 31	.. Do. do. ..		..			1,485	2	0
Sept. 30	.. Do. do. ..		..			1,509	5	3
Oct. 31	.. Do. do. ..		..			1,407	17	10
Nov. 30	.. Do. do. ..		..			1,815	9	3
Dec. 31	.. Do. do. ..		..			1,421	13	1
	.. Balance carried forward, being							
	Stock on hand .. ..		..			5,318	0	0
						£	23,450	3 1

Dr.

WAGES

1902				£	s	d	£	s	d
Jan.	31	To Cash, per Cash Book	..	..	..	..	1,595	5	4
Feb.	28	„ Do. do.	..	..	..	..	1,600	11	4
Mar.	31	„ Do. do.	..	..	..	..	1,516	3	1
April	30	„ Do. do.	..	..	..	..	1,491	6	0
May	31	„ Do. do.	..	..	..	..	1,499	7	6
June	30	„ Do. do.	..	..	..	..	1,418	8	8
July	31	„ Do. do.	..	..	..	..	1,563	2	0
Aug.	31	„ Do. do.	..	..	..	..	1,474	5	0
Sept.	30	„ Do. do.	..	..	..	..	1,480	6	0
Oct.	31	„ Do. do.	..	..	..	..	1,474	4	0
Nov.	30	„ Do. do.	1,548	18	9
Dec.	31	„ Do. do.	1,077	0	0
							£	17,738	17 8

ENGINEERS' AND SHIPBUILDERS' ACCOUNTS.

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ACCOUNT.

Cr.

1902				£	s	d	£	s	d
Jan.	31	By Sundries, as per Journal	1,595	5	4
Feb.	28	„ Do. do.	1,600	11	4
Mar.	31	„ Do. do.	..	..	..	..	1,516	3	1
April	30	„ Do. do.	..	..	..	..	1,491	6	0
May	31	„ Do. do.	..	..	..	..	1,499	7	6
June	30	„ Do. do.	..	..	..	..	1,418	8	8
July	31	„ Do. do.	..	..	..	..	1,563	2	0
Aug.	31	„ Do. do.	..	..	..	..	1,474	5	0
Sept.	30	„ Do. do.	..	..	..	..	1,480	6	0
Oct.	31	„ Do. do.	..	..	..	..	1,474	4	0
Nov.	30	„ Do. do.	..	..	..	..	1,548	18	9
Dec.	31	„ Do. do.	..	..	..	..	1,077	0	0
							£	17,738	17 8

Specimen No. 22.—

Dr.	TRADE ACCOUNT, 12 months ending 31st December 1902.					Cr.	
	£	s	d	£	s	d	£
To Rent, Rates, and Taxes ..	462	3	4				35,553
" Gas and Water ..	197	6	0				11
" Insurance ..	70	0	0				2
" Discount ..	119	7	10				
" Management Wages ..	1,200	0	0	848	17	2	7,399
" Drawing Office Wages ..	600	0	0				0
" Travelling Expenses ..	37	10	6				0
" Stationery ..	51	0	0				
" Engine Coal ..	400	10	0	1,888	10	6	
" Running Machinery ..	500	0	0				
" Smithy Coal ..	300	0	0				
" Carting ..	54	6	9				
" Railway Carriage ..	213	13	4	1,468	10	1	
" Machinery Repairs ..	310	12	2				
" Building Repairs ..	193	4	7	503	16	9	
" Pattern Making ..	381	3	7				
" Manufacturing Account ..	34,970	6	5	35	351	0	
" Balance carried to Profit ..				2,891	6	8	
" and Loss Account ..				£ 42,952	11	2	£ 42,952

Dr. PROFIT AND LOSS ACCOUNT, 12 months ending 31st December 1902. *Cr.*

	£	s	d	£	s	d	By Balance brought from Trade Account	£	s	d	£	s	d
To Depreciation :—													
On Buildings at 5% ..	75	0	0										
„ Machinery and Plant at 5% ..	600	0	0										
„ Patterns at 10% ..	150	0	0										
„ Balance available for distribution ..													
				825	0	0							
				2,066	6	8							
				<u>£2,891</u>	<u>6</u>	<u>8</u>					<u>£2,891</u>	<u>6</u>	<u>8</u>

Specimen No. 23.

BALANCE SHEET.

<i>Capital and Liabilities.</i>		<i>Property and Assets.</i>	
£	s d	£	s d
Nominal Capital £25,000 in 1,500 Ordinary Shares of £10 each, and 1,000 Preferred Shares of £10 each		Freehold Land	
SUSCRIBED CAPITAL :—		Buildings	
1,500 Ordinary Shares of £10 each fully paid ..		Less Depreciation 5% ..	
1,000 Preferred Shares of £10 each fully paid ..		Machinery and Plant :—	
15,000 0 0		As per last Balance Sheet	
10,000 0 0		Additions	
		11,721 0 0	
		279 0 0	
		12,000 0 0	
		600 0 0	
		11,400 0 0	
Sundry Trade Creditors on Open Accounts		Less Depreciation 5% ..	
Reserve Fund		Patterns :—	
Profit and Loss Account :—		As per last Balance Sheet	
Balance available for distribution		Additions	
		1,500 0 0	
		150 0 0	
		1,350 0 0	
		8,430 6 7	
		2,167 2 1	
		301 4 3	
		5,318 0 0	
		7,399 0 0	
		12,717 0 0	
		£39,790 12 11	

Specimen No. 24.—

JOURNAL.

		£	s	d	£	s	d
Jan. 31	Sundries, <i>Dr.</i> to Stores Account .. .. .	..	..	..	1,500	3	5
	Running Machinery	9	7	4			
	Machinery Repairs	16	7	6			
	Building Repairs	0	17	6			
	Pattern Making	0	17	6			
	Manufacturing Account	1,472	13	7			
	Sundries, <i>Dr.</i> to Wages Account .. .. .	..	..	..	1,595	5	4
	Running Machinery	28	0	0			
	Machinery Repairs	43	1	6			
	Building Repairs	74	9	10			
	Pattern Making	37	10	0			
	Manufacturing Account	1,412	4	0			
Feb. 28	Sundries, <i>Dr.</i> to Stores Account .. .. .	..	..	..	1,487	3	7
	Running Machinery	8	17	1			
	Machinery Repairs	52	9	6			
	Pattern Making	1	7	6			
	Manufacturing Account	1,424	9	6			
	Sundries, <i>Dr.</i> to Wages Account .. .. .	..	..	..	1,600	11	4
	Running Machinery	28	0	0			
	Machinery Repairs	116	9	4			
	Pattern Making	43	0	0			
	Manufacturing Account	1,413	2	0			
Mar. 31	Sundries, <i>Dr.</i> to Stores Account .. .. .	..	..	..	1,332	3	10
	Running Machinery	12	1	6			
	Machinery Repairs	1	4	3			
	Pattern Making	2	8	0			
	Manufacturing Account	1,316	10	1			
	Sundries, <i>Dr.</i> to Wages Account .. .. .	..	..	..	1,516	3	1
	Running Machinery	35	0	0			
	Machinery Repairs	23	0	1			
	Pattern Making	43	0	0			
	Manufacturing Account	1,415	3	0			
Apr. 30	Sundries, <i>Dr.</i> to Stores Account .. .. .	..	..	..	1,571	0	6
	Running Machinery	7	3	2			
	Pattern Making	1	10	0			
	Manufacturing Account	1,562	7	4			
	Sundries, <i>Dr.</i> to Wages Account .. .. .	..	..	..	1,491	6	0
	Running Machinery	28	0	0			
	Pattern Making	43	0	0			
	Manufacturing Account	1,420	6	0			
May 31	Sundries, <i>Dr.</i> to Stores Account .. .. .	..	..	..	1,529	7	4
	Running Machinery	8	10	0			
	Pattern Making	3	13	6			
	Manufacturing Account	1,517	3	10			
	Sundries, <i>Dr.</i> to Wages Account .. .. .	..	..	..	1,499	7	6
	Running Machinery	38	0	0			
	Pattern Making	43	0	0			
	Manufacturing Account	1,418	7	6			

JOURNAL—continued.

		£	s	d	£	s	d
June 30	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,339	16	1
	Running Machinery	15	11	6			
	Building Repairs	1	3	4			
	Pattern Making	2	18	6			
	Manufacturing Account	1,320	2	9			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,418	8	8
	Running Machinery	35	0	0			
	Building Repairs	37	2	8			
	Pattern Making	45	0	0			
	Manufacturing Account	1,301	6	0			
July 31	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,733	0	11
	Running Machinery	9	7	4			
	Pattern Making	2	10	0			
	Manufacturing Account	1,721	3	7			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,563	2	0
	Running Machinery	28	0	0			
	Pattern Making	34	0	0			
	Manufacturing Account	1,501	2	0			
	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,485	2	0
	Running Machinery	8	13	6			
Aug. 31	Manufacturing Account	1,476	8	6			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,474	5	0
	Running Machinery	28	0	0			
	Pattern Making	27	0	0			
	Manufacturing Account	1,419	5	0			
	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,509	5	3
	Running Machinery	6	1	10			
	Pattern Making	3	0	0			
	Manufacturing Account	1,500	3	5			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,480	6	0
Sept. 30	Running Machinery	35	0	0			
	Pattern Making	27	0	0			
	Manufacturing Account	1,418	6	0			
	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,407	17	10
	Running Machinery	10	7	9			
	Manufacturing Account	1,397	10	1			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,474	4	0
	Running Machinery	38	0	0			
	Pattern Making	23	0	0			
	Manufacturing Account	1,413	4	0			
Oct. 31	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,815	9	3
	Running Machinery	14	6	0			
	Pattern Making	2	18	7			
	Manufacturing Account	1,796	3	2			
	Building Repairs	2	1	6			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,548	18	9
	Running Machinery	28	0	0			
	Pattern Making	54	10	0			
	Manufacturing Account	1,423	5	0			
	Building Repairs	43	3	9			
Nov. 30	Sundries, Dr. to Stores Account .. .. .	..	..	..	1,815	9	3
	Running Machinery	14	6	0			
	Pattern Making	2	18	7			
	Manufacturing Account	1,796	3	2			
	Building Repairs	2	1	6			
	Sundries, Dr. to Wages Account .. .. .	..	..	..	1,548	18	9
	Running Machinery	28	0	0			
	Pattern Making	54	10	0			
	Manufacturing Account	1,423	5	0			
	Building Repairs	43	3	9			

JOURNAL—continued.

		£	s	d	£	s	d
Dec. 31	Sundries, <i>Dr.</i> to Stores Account .. .. .	..	..	..	1,421	13	1
	Running Machinery	5	13	0			
	Manufacturing Account	1,416	0	1			
	Sundries, <i>Dr.</i> to Wages Account .. .. .	..	..	..	1,077	0	0
	Running Machinery	35	0	0			
	Pattern Making	40	0	0			
	Manufacturing Account	1,002	0	0			
Dec. 31	Trade Account, <i>Dr.</i> to Sundries	40,061	4	6	462	3	4
	Rent, Rates, and Taxes .. .. .	..	..	..	197	6	0
	Gas and Water .. .. .	..	..	..	70	0	0
	Insurance .. .. .	..	..	..	119	7	10
	Discount .. .. .	..	..	..	1,200	0	0
	Management Wages .. .. .	..	..	..	600	0	0
	Drawing Office Wages .. .. .	..	..	..	37	10	6
	Travelling Expenses .. .. .	..	..	..	51	0	0
	Stationery .. .. .	..	..	..	400	10	0
	Engine Coal .. .. .	..	..	..	300	0	0
	Smithy Coal .. .. .	..	..	..	54	6	9
	Carting .. .. .	..	..	..	213	13	4
	Railway Carriage .. .. .	..	..	..	310	12	2
	Machinery Repairs .. .. .	..	..	..	103	4	7
	Building Repairs .. .. .	..	..	..	381	3	7
	Pattern Making Account .. .. .	..	..	..	34,970	6	5
	Manufacturing Account .. .. .	..	..	..	500	0	0
	Running Machinery .. .. .	..	..	..
	Sales Account, <i>Dr.</i>	35,553	11	2			
	To Trade Account .. .. .	..	..	..	35,553	11	2
Dec. 31	Profit and Loss Account, <i>Dr.</i> to	825	0	0			
	Freehold Buildings for Depreciation at 5% .. .. .	..	..	..	75	0	0
	Machinery and Plant Do. at 5% .. .. .	..	..	..	600	0	0
	Patterns Do. at 10% .. .. .	..	..	..	150	0	0
	Pattern Account, <i>Dr.</i>	100	0	0			
	To Pattern Making Account .. .. .	..	..	..	100	0	0
	(For Estimated Value of additions to Patterns)						

If we pursue these Ledger Accounts in their order, the first (Share Capital) requires no special notice. It is the ordinary Capital Account of a joint-stock company, and governed by the conditions of promotion and the issue of shares of the company. Excepting fresh capital is raised, or a reduction of share values is sanctioned by the Supreme Court consequent upon losses in trading, it remains unaltered from year to year.

The next account, Reserve Fund, is deserving of very careful consideration on the part of directors and officers responsible

for the financing of the company or firm. There is a great difference in the character of reserves for banking, financial, or merchant businesses, and those for manufacturing and producing concerns. In the former, the danger to be guarded against is a direct loss in trading; in the latter, there is not only this possible direct loss to be provided for, but also funds to be set aside for the replacement of buildings and machinery used in the business. By treating these several purposes in one account, and employing the money reserved in the ordinary business of the company, there is always a danger that one of the risks so insured against will be neglected or postponed when a more pressing demand presents itself. A threefold accumulation is required, viz.:—

- (1) For equalisation of dividends and reserve against general trade contingencies.
- (2) For development and replacement of buildings.
- (3) For replacement of machinery.

The first reserve is demanded by a failing in human nature, from which shareholders are by no means free—from a disinclination to accept without murmuring an unavoidable diminution of happiness. When a bad trading year comes round directors are frequently, and sometimes unjustly, blamed for losses which have been caused by the general course of the market, and not by any action of the individual board. It is, therefore, more usual than is generally supposed to make some provision of this kind, unknown to the shareholders, by reducing the value of the stock or work in progress at the close of a prosperous year, so as to have something in hand for a succeeding lean one. The expedient is, however, a temporary one, ineffective over a long period, and unscientific in method. It is much better to fix a maximum dividend, not by articles of association, nor by special resolution having an inflexible force,

but by mutual understanding and agreement at the general meeting; and, when in any year the profits exceed the amount required to pay this dividend, to carry the excess to reserve, and add any similar balances to it from time to time. This accumulation should appear distinctly in the account books and Balance Sheets as "Reserve for equalisation of dividends and against general contingencies," or some similar title which will properly define the objects to which it can be applied. It may generally be employed in the business, since the demands upon it can be foreseen and provided for, when the course of the trading is sound, by an arrangement with the firm's bankers; but there must be no misunderstanding about the way in which this reserved profit is calculated. All Dividends declared and paid, all Depreciation, Repairs, Replacements, and other contingencies must be written off the Profit and Loss Account before any amount is transferred to Reserve, with as much circumspection as if the money were to be immediately used in the payment of an additional dividend. If there is not this "morality of accountancy," a very delusive statement may be presented to the shareholders.

The second reserve—that for Replacement of Buildings—is irrespective of profits made. The amount which, after mature consideration, is deemed necessary, must be written off the value of buildings each year, whether a profit or loss has been made in trading—before, indeed, such profit or loss can be ascertained. This, indeed, is the usual practice as shown in the Profit and Loss Account and Balance Sheet (Specimens Nos. 22 and 23), but, unfortunately, it is seldom carried to its legitimate conclusion. The deduction is made for a specific purpose—to replace buildings which in the ordinary course of time must become worn out and useless. The money ought therefore to be available for this purpose, and, more especially in small firms, where the temptations to use it are great, ought

to be invested in marketable or readily available securities outside the business. Mortgages, when they are first charges with a sufficient margin, are a perfectly legitimate and sound security for this purpose: they can be obtained to afford fair rates of interest, and can readily be transferred when the money is required. Moreover, as the approximate dates when the rebuilding will be needful can be calculated with some degree of precision, the loans can be arranged for terms of 10 or 15 years, so that the repayment will synchronise with the rebuilding.

One factor, however, affects these buildings reserves in the present day, which was absent, or of less importance, in past times. The tendency to expansion of works, to amalgamation of firms, to trade combines, has its reflex in the demand for larger and more spacious buildings; and the substitution of machinery for manual labour, which every day increases, renders cramped workshops with partition walls and passages economically objectionable. In the case of Shipbuilding-yards, this feature is accentuated by the increased length of modern ships. Slipways, which 20 years ago afforded ample space for the building of a first-class liner, have now to be lengthened and otherwise extended for laying down a steamer like the *DEUTSCHLAND* or the *IVERNIA*. A very grave question, therefore arises whether sufficient provision is made at the present time by the majority of Engineering and Shipbuilding firms for rebuilding workshops, or whether some portion of such cost is not sometimes thrown upon the Capital Account instead of being provided for out of prior profits.

The third reserve—that for Replacement of Machinery—will follow the same lines as the second reserve, but the reasons for investing it outside the business, and earmarking the securities for it, are even more imperative. It is impossible to take up

any of the Engineering magazines without observing the rapid progress which is being made in improvement of machine tools, and the great development of labour-saving appliances. Lathes by the very best makers become out of date, not because they are untrue, not because they do not turn out sound and reliable work; but because they are wanting in some appliances fitted to modern, and maybe inferior, lathes which increase the speed of working. The adoption of standard sizes and angles promotes the use of chucks and special cutters, and renders the old-fashioned machine an incumbrance in the workshop. The modern Engineer is therefore ever face to face with an artificial ratio of Depreciation—with a Depreciation which does not effectively operate merely when his machinery is worn out, but at the far earlier period when some rival has invented an improvement. If, therefore, he wishes his business to be perfectly sound he will accumulate a machinery replacement, or improvement, fund as rapidly as possible, and invest it in readily available and marketable securities outside his own particular business.

The auditor has special and onerous obligations thrown upon him in relation to Ship-yards and Engineering Works, and should bring to his work a considerable amount of common-sense. The ordinary checking of postings must receive careful attention, and the examination of the Invoice Book demands special consideration. The amounts of the invoices will most probably be correct; the debits to Stores and Timber Accounts will be found in order; the charges for Coal Carriage, Stationery, Rent, and the like, are very easy to check; but the auditor will need to be alert when any debits are transferred to New Machinery or New Buildings. A new lathe is placed in the shops, and the question arises: Is it an addition, a replacement, or a substitution? If it is a substitution for one which is yet mechanically perfect, but economically out of date, then

must be considered the addition, if any, which has been made to the value of the plant at the works. The problem is not an easy one to solve, and dogmatic rules cannot be laid down for it: the auditor must take counsel with the works' manager, with the foremen who superintend the tools, not with the bookkeeping and clerical element, and from their experience gather such help as he can to estimate the value of the item. With the best intentions and the widest experience, alterations in, and additions to, machinery will be a source of grave anxiety to the auditor, and demand his most solicitous examination.

The Stores Ledger, if properly kept, is a valuable check upon the stocktaking. The goods in store should be weighed or counted by an independent officer of the company, and entered in a book or on sheets. The quantities so arrived at should correspond—very nearly—with the balances shown in the Stores Ledger. It will seldom be possible to check all the postings of the Stores Books, but the total of the money balances of the Stores Ledger should correspond with the balance of Stores Account in the General Ledger. In every case, however, it is desirable to check some of the storekeeper's work, and this checking should be of various items taken at haphazard throughout the entire period.

In Ship-yards a great discrepancy will be found in the Timber Accounts. This cannot be avoided without seriously impeding the work, or without the introduction of a system of Cost Cards, to which the British workman has not yet become accustomed. An account of the variation between the actual stocktaking quantities and the Timber Ledger quantities should, however, be extracted at each audit, and the attention of the managers drawn to it. This will probably tend to reduce the limits of variation, but, after all, it is purely a matter of yard management.

The foundations and beds for machinery require close scrutiny. They are really part of the cost of the machinery in place, as it is unworkable without them, and the cost may vary considerably in consequence of the character and position of the works and local conditions. Superintendence during erection is a perfectly legitimate charge to make, but it must not be more than the actual value of it—that is to say, the firm must not make the machinery more costly by doing the work themselves than it would have been if erected by an outside contractor. Here, again, the auditor will require, above all things, to exercise common-sense and the gentle manners the Latin proverb commends.

In some Ship-yards the slipways have to be underpiled. The cost of this work is great, and the uninitiated visitor would see no evidence of it. Careful enquiry may help the auditor to satisfy himself that the charge is not excessive, but it can only help him; he is ultimately very largely at the mercy of the yard officials.

The Cost Accounts referred to in the next chapter are prepared for technical financing, rather than for business financing, and are subject to so many technical and professional limitations that little or no good would accrue from detailed auditing of them. Their correctness depends upon a vast number of minute items, which no after examination would set right if they were improperly treated at the time, but the professional auditor can render valuable assistance to the Engineer in inaugurating a proper system, although he must rely on the works' bookkeepers for seeing that such system is properly carried out.

CHAPTER VII.

COST ACCOUNTS.

THE most specialised portion of Engineering bookkeeping is that known as the Cost Accounts. Since Messrs. Garcke and Fells published their classical work on Factory Accounts numerous treatises have been written on the subject, some of them by practical Engineers and others by public accountants, and many and varied systems have been submitted for public approval. Even the principles upon which these accounts should be compiled are not agreed upon. One recent writer says, "There is much difference of opinion as to how the oncost should be allocated." The same writer says, "Cost has been defined by economists as the total values of the materials, services, labour, and capital entering into any product." Whilst he again divides this cost into conditions, which he thus defines:—

"*Prime Cost* is the summation of the cost of materials, labour, and outside services, chargeable solely and directly against the product."

"*Oncost* is the direct expenditure incurred for the purpose of increasing the productive power of labour, and includes every outlay whatever not chargeable to a specific product. Oncost includes Depreciation for tear and wear, obsolescence, and all safeguards of capital against risks and casualties, but the remuneration of capital is not included as oncost."

"*Gross Cost* is the sum of prime cost and oncost."

"*Net Cost* is the gross cost, less the value, for future use of any plant or tools made specially for the production of the special contract."

There is a delightfully equivocal vagueness about these sentences, which sufficiently indicates the difficulties of the subject, and the varied methods by which it may be treated.

One very usual method is to charge to each contract, or job, or repair, all the direct wages and materials employed for it, thus arriving at the "Prime Cost" before referred to, and to add thereto a fixed percentage for "Oncost," or, as it is more frequently termed south of the Tweed, for "Establishment Charges." Specimen No. 15 is an example of a book which has been, for the past 15 years, found very useful for this purpose in a large General Engineering Factory.

No.....

CONTRACT BOOK, 3/476.

Name.

Description of Machine or Work.

Special Conditions... ..

[illegible]

In the factory in question the Annual Wages amounted to ..	£52,000
From these are deducted the Wages of the Foremen Pattern Makers, Moulders, and Fitters, of the Labourers, Engine Driver, Carters, and of the Management Staff	16,150
Leaving Productive Wages	35,850
Add 105 per cent., say	37,642
Cost of Products, exclusive of Material	<u>£73,492</u>

On reference to the Commercial Accounts of the firm the gross

Trade Expenditure was found to be £105,700

But from this had to be deducted the following amounts for
Materials issued to the respective departments for work
upon them, viz. :—

Fitting and Turning	£16,000
Smithy	2,100
Foundry	12,200
And for Machinery additions .. .	2,500
	<u>32,800</u>

Leaving Cost of Production, exclusive of Material .. £72,900

It will thus be seen that in this particular instance 105 per cent. for Establishment Charges was as nearly correct as such a percentage can be, when taken over the entire factory and averaged for the whole 12 months. Great care will, however, have to be taken that none but actually productive—that is, skilled artisans—wages are charged in the Cost Book under the head of the several trades, and that all labourers and untrained men are relegated to the 105 per cent. added. Blacksmiths' strikers, whom some might term labourers, are a seeming exception to this rule, and are included under the head of smiths, but then they are really trained men—almost as much skilled artisans as the blacksmiths themselves.

The great objection to this method is the want of uniformity of work, both of quantity and quality. It is evident that in

shops liable to great pressure during certain prosperous epochs, and to lack of work during lean years, the percentage cannot be maintained at the same figure without great inaccuracy in costing. Even the merest tyro in Engineering will understand that it is utterly impracticable to reduce Management Wages, Rent, Insurance, Running Machinery, Depreciation, and other general expenses in the same time, or in the same ratio, as productive (skilled labour) wages are depleted. There is also another grave objection to it as it is usually employed. Whilst the gross cost of a machine, a contract, or an installation, considered as a whole, may be thus arrived at, it does not readily lend itself to the costing of parts. In a foot or treadle press, for instance, there are 26 or more parts, and for accurate detailed costing each of those parts must be treated as a separate entity. The reader will see that great difficulty would arise in treating so many different parts in a book ruled and kept as in Specimen No. 25, though, of course, it is not impossible.

A second method, advocated by many Works' Engineers, and supported by arguments founded on the most profound problems of the calculus, is to debit each particular item of work with a charge per hour for the machine used upon it. Thus, in a factory there is a large machine costing £4,000.

The Annual Charge for area occupied is said to be	£232	16	0
The Interest on the Machine Cost	200	0	0
And the Depreciation	400	0	0

This would be charged against any work upon which it is used, at the rate of 8s. 5d. per hour.

In the same factory there is a smaller machine, costing £200.

The Charge for area occupied is	£6	15	0
Interest	10	0	0
Depreciation	10	0	0

and the charge for this machine against any work upon which it is employed would only be $\frac{1}{2}$ d. per hour. To ensure proper charging of the whole of the machinery it would be necessary to open an account for each machine, and credit such account with its hypothetical earnings through the Cost Book. It is hardly possible to employ all the machinery of an amply-equipped factory at the same time; there must be long periods when many of the machines lie idle, and for these periods no provision is made by most Engineers who adopt this method, although the floor space must remain occupied, and Interest, and at least part of the Depreciation, be running on. Of necessity such Cost Accounts show better results than the commercial books of the firm—that is, they show a smaller cost of production than actually exists, and a consequent higher, but fallacious, margin of profit.

Mr. David Cowan, in a paper read before the Institution of Engineers and Shipbuilders in Scotland, on the 19th March 1901, very forcibly points out the difficulties of machine charges. He is evidently thinking chiefly of the incidence of Depreciation, with which he has been dealing in the preceding paragraph, but his words are so graphic and pertinent, and so full of meaning with regard to machine charges generally, that they may be reproduced here with great advantage, for the warning and instruction of the reader.

“One machine may cost, installed complete, say, £2,000 or more; for its operation it will require a large amount of power and crane service, and may have to be attended to by one highly-skilled craftsman, with now and then some attendance from unattached labour. It is subject to a Depreciation charge corresponding in amount to the capital invested therein, and the class to which it belongs. Another may only cost £200 or less, and being nearly automatic in its action, may only require the attention of a low-grade man, either during the whole or part of his time. It requires probably very little power to drive it; it needs no auxiliary service, and carries a Depreciation charge very different from the larger machine. It is

evident that real cost of work performed on the larger machine, taking rent of capital, shop floor space, services, and all other usual items into consideration, is much greater than that of the smaller machine.

“ When no capital charge is made, and the depreciation and other shop charges are departmentally averaged up all round, and when these are recovered on the quantities of labour, the charge for facilities per hour of the machinists in such cases is the same—that is to say, the less costly machine is too highly weighted, and the more costly too lightly. The question is: Does the difference in weighting in the case of the smaller priced machine properly compensate for the greater share of the shop facilities provided, which the low-grade labour operating it uses up? Should each machine bear the same load of oncost, or should this load differ for each? Which should carry the greater, and which the lesser?

“ To answer these questions properly, for the two types of machines cited, and for all the machines intermediate between them, special considerations are necessary in each case. Although the cost of one machine may be high, yet, in computing the Depreciation, a lower rate of charge may be sufficient, if this machine is of a standard type; in the other it may be much higher if the machine be classed as special or semi-special. Likely enough, in the case of the special machine, more repairs would be required, as also more outlays for cutting tools and for supervision on the part of some special superintending tool maker. The more costly tool may be idle for a considerable part of its time; the other may be running to its full capacity, or it may be partly idle. Many other considerations besides these enter into such questions. They cannot be answered in a general way; each case requires special consideration. The running time of each should be kept, as is done with individual workmen. An estimation of power for driving, and the rent of the capital invested in each, is required. Accounts based on these data, and all ordinary running expenses, are a necessity if the separate hourly cost of running is demanded.

“ It can be conceived that there may be occasion for such an accounting. Such occasions are more likely to arise in the future than in the past. In an engineering shop making a variety of heavy products, in the present state of the art of shop management, such a state of accounting is neither possible nor desirable. In the case where products are much alike, and specialised, it is unnecessary.

“ When the machine tools in any department do not, vary greatly in capacity or value, it serves no useful purpose to make specific individual

charges for each, since it is not always possible to assign just the kind of work most suitable to the performance of each. For most ends it is sufficient to average matters up all round, and trust to the executive officials in charge to do the best they can, as, when there is not a sufficiency of work for the heavy tool, and there is more light work in the shop than can be overtaken, then the heavy tool may be used for light work. Such adaptations are, however, difficult with tools of the special class."

It is hardly necessary to adduce further reasons for saying that Cost Accounts, based on separate charges for each machine employed, must be generally hypothetical, and that in many if not in the majority of cases they must be delusively hypothetical. The commercial Trading Account will generally point the moral.

No Cost Accounts can be considered satisfactory, from an accountant's points of view, unless they can be checked by the Trade Account of the firm. But as these accounts are compiled for the purposes of the Engineer—for his estimates and shop management—changes are continually being made in them, fresh details being introduced and others withdrawn, and the interlocking of them with the commercial books is therefore troublesome, and, in many cases, costly. The final results should, however, agree, if the two records are compiled from the same subsidiary books, and equal care is taken with each of them. Some difficulty arises in framing Cost Accounts, owing to the requirements of the Engineer, and the varied purposes for which he employs the figures not being sufficiently considered. If they are to be of the fullest possible service to him they must be of a threefold character, and must show him his expenditure (in materials and wages separately) on:—

- (a) The various departments—such as Offices, Mould Loft, Joiners, Pattern Makers, Moulders, Machinemen, Blacksmiths, Fitters, &c.

- (b) The various sections of each contract ; as, for instance, Cylinders (high, intermediate, and low pressure), Cylinder Fittings, Cylinder Covering, Pistons, Connecting Rods, Crank Shaft, &c., each section having its cost completed independently and in its own entirety.
- (c) The total cost of each separate contract.

In a series of articles in *Engineering*, commencing 5th January 1894, the writer first suggested the following forms of Cost Accounts, which appear to meet the somewhat complex problem which is presented, and are at the same time capable of agreement with the commercial accounts of the expenditure of the firm. The same original books of record (Invoice Book, Cash Book, Wages Book, &c.) are used for both statements, and, though the figures are manipulated in different ways, the exercise of ordinary care should prevent any great discrepancy. There must, however, be no evasion of the prime fact which underlies all true costing. All the expenditure of the firm ; all wages of managers, foremen, draughtsmen, and clerks ; all materials and workmen's wages, and Depreciation of plant and buildings (which under another form is payment for their use) : in short, all the expenditure which appears on the debit side of the Trading Account is cost of production, and must in some form or other appear in the Cost Accounts. The costings should be completed, so far as the A Sheets hereafter described are concerned, to the close of each month, as longer periods would involve much complication, and it is essential for correct results that *the establishment charges for any one month are distributed over the direct wages for that month, and over no other.*

The forms are threefold, to answer to the threefold requirements of the Engineer already indicated.

Form A, for Departmental Accounts.

Form B, for Process Accounts—process meaning the sectional portion of any particular machine or contract, such as a lathe-frame or propeller shaft.

Form C, for Contract Accounts.

It will easily be seen that the majority of charges will follow this sequence: iron issued to the smiths will pass into that department for labour on it; when transformed into a ship's davit it will be transferred into its proper place in the Process Accounts; and when a final collection of all the charges against the contract is made, it will find its resting place under one of the headings in Form C. But there is an earlier sequence in the A Sheets, in consequence of establishment charges having to be dealt with as a primary departmental charge, to be distributed over other departments in the ratio of the wages paid in them. The grouping or division of these charges is a matter of internal arrangement, and will vary with the conditions and requirements of each particular yard or factory. In Specimen No. 26 the title used is "Management Expenses," but it may be supposed to include general office expenses, running machinery, timekeeping, storekeeping, carting, and all the thousand and one expenses which do not belong exclusively to any single department, but are necessary for the working of all.

SHEET A.

MANAGEMENT EXPENSES, January 1902.

<i>Debits</i>	Materials and Expenses	Salaries and Wages	<i>Credits</i>	Materials and Expenses	Salaries and Wages
Stock, January 1st 1902	£ s d	£ s d		£ s d	£ s
Purchases per Invoice Book—			Transfers to B & C Sheets—		
Engine Coal			B Sheet—Ackroyd Colliery		
Railway Carriage			Company		
Stationery			Expenses in arranging Con-		
Rent, Rates, and Taxes			tract		
Insurance					
Gas and Water			Transfers to Departments—		
Sundries			Pattern Makers— $\frac{2}{6}$		
Salaries and Wages—			Moulders		
Directors' Fees			Blacksmiths		
Managers and Secretary			Machinemen		
Drawing Office			Fitters		
General Office					
Subordinate Officials					
Cash Payments—					
Postage and Receipt Stamps					
Travelling Expenses					
Petty Cash Payments					

On the debit side of the account, the purchases obtained from the Invoice Book must agree with the totals of the respective Analysis columns. The Salaries and Wages will be extracted from the Directors' Fee Book, the Salary Book, and the Analysis of Wages; whilst the Cash payments will be taken from the Cash Book, care being exercised that no amount is included as a purchase through the Invoice Book, and also as a cash payment. On the debit side of the account will be noticed a transfer to B Sheet for expenses in arranging a contract with the Ackroyd Colliery Company. A new colliery is being opened out; the directors and manager of the Engineering Company have spent a considerable time, and incurred expenses in having drawings prepared, in order to secure the contract for the equipment of this pit. It is a specific expense for a specific object, and can be easily separated from other management expenses. It is, therefore, charged to a B Account, which may be entitled "Preliminary Expenses for Ackroyd Colliery Contract No. 4,746." The difference between this amount and the total debits are transferred to the different producing departments in proportion to the working wages paid in them. Thus, if pattern-makers' wages are one-twentieth part of the whole, then that department will be debited one-twentieth part of the management expenses for the month, and so on through all the producing or manufacturing departments.

Specimen No. 27 deals with Stores Receipts and Issues. It is really a summary of the Stores Receipts Book and Stores Issued Book, with the necessary adjustment of stock, and is only included in the Cost Accounts for convenience of reference. The purchases per Invoice Book and per Cash Book will correspond with the total of the Stores Received Book for the month (Specimen No. 4), and the Returns from Departments will also correspond with the total for the month of the book (Specimen No. 6). On the credit side of the account the issues

to departments will correspond with and agree in total with the Stores Issued Book (Specimen No. 5), whilst the returns to manufacturers will correspond with the book kept for that purpose, as in Specimen No. 7. The stock on hand should agree each month end, both with the total of the stock in the various accounts of the Stores Ledger, and with the balance of the Stores Account in the General Ledger.

The numbers given on both sides of the account—namely, for returns from, and issues to, departments—are the distinguishing marks of the various contracts or jobs affected by the transactions. No special importance must be attached to them, as each particular factory has its own method of earmarking its contracts or jobs, and the mode adopted is usually determined more by Engineering and Drawing Office necessities than by commercial or clerical convenience. What is of supreme importance is that, by some means or other, each job, contract, or building, or machine repair shall be absolutely distinguished from all others throughout its career.

The Departmental Accounts all present the same character. They will be opened for pattern makers, moulders, machine men, smiths, fitters, and any other trades which may be employed. Thus, in a Shipbuilding-yard, in addition to these five, there will be platers, rivetters, joiners, and shipwrights; whilst in specialised factories—such as electrical or gun-making manufactories—other trades or sub-divisions of trades will be introduced. It is well to here observe one marked distinction between the costing of a Machine-making Factory and that of a Ship-yard. In the former, whether it be a tool-making, textile machine-making, or engine-building factory, the cost of each particular item of the structure is required, whereas in the latter the division is rather into particular parts of a ship, although such parts might, on the machine-shop principle, be sub-divided into numerous details. Thus, for a foot-press (we

are quoting from an American symbol system), the cost will be separately arrived at for the frame, jib, side bar, front leg, back leg, treadle, lever, lever weight, &c., &c., and each of these details would in some way or other be distinguished as a subdivision of the contract. In a ship, on the other hand, the costs are usually taken for such broad detachments as Frames, Plating and Rivetting, Rudder, Bulkheads, Main Deck, Davits, Cabins and Fittings, Saloon, &c., although some of these items—such as Cabin Fittings—comprise a considerable number of articles—settees, sideboards, chairs, tables, lockers, and berths—which are distinct from each other and manufactured entirely separately. This difference does not affect the principle of costing; it is merely an adaptation, which is constantly varying, to the requirements of the particular firm.

No difficulty arises on the debit side of the Shipwrights' (or other Trade) Account A. The purchases are derived from the Invoice Book, but only when special goods have been bought for a specific object; the transfers from Stores department will agree with credit entries on the Stores Sheet, and those for management charges, motive power, and drawing office with corresponding anterior sheets. The items Interest and Depreciation are those charges on the machinery employed in the particular department. But the opposite side of the account demands more attention and care. We have to transfer to a B Sheet headed "Ship 47—Pumps," the charges against that particular work, which has been finished during the month. These charges are the pumps purchased from Gwynne & Co., the wages paid for fitting them in place, the materials issued for them from the stores, together with the proportion of establishment charges, inclusive of interest and depreciation, for the month, apportioned in ratio to the direct wages paid. The following tables will explain the method of doing this, it being clearly understood that the distribution is made over work in

progress carried forward as stock, as well as over work sufficiently finished to be transferred to B Sheets. The direct wages are £124 16s. 0d. The establishment charges in the Materials and Expenses column, including Interest and Depreciation, amount to £33 6s. 2d., and in the Salaries and Wages column to £26 3s. 4d.

			Materials and Expenses	Add Proportion of Establish- ment Charges	Amount to Credit
			£ s d	£ s d	£ s d
Item No. 1	..	..	114 1 6	16 1 10	130 3 4
" 2	..	..	..	3 9 10	3 9 10
" 3	..	..	2 8 7	8 7 6	10 16 1
" 4	..	..	1 6 4	4 16 3	6 2 7
" 5	..	..	..	10 9	10 9
			<u>£117 16 5</u>	<u>£33 6 2</u>	<u>£151 2 7</u>

			Direct Wages	Add Proportion of Establish- ment Charges	Amount to Credit
			£ s d	£ s d	£ s d
Item No. 1	..	..	60 5 6	12 12 9	72 18 3
" 2	..	..	13 1 4	2 14 9	15 16 1
" 3	..	..	31 6 8	6 11 5	37 18 1
" 4	..	..	18 1 6	3 15 9	21 17 3
" 5	..	..	2 1 0	8 8	2 9 8
			<u>£124 16 0</u>	<u>£26 3 4</u>	<u>£150 19 4</u>

When the transfers and stock on the credit side of the account are calculated in this manner they will exactly balance the debit side.

The form of the B Sheet differs slightly from that of the A Sheet, because the work transferred to it may extend over many months before it is completed. The laying of the decks of a large ocean liner like the OCEANIC would probably extend over

two or three months. The cost would not be carried forward as work in progress, that being intended only for specific jobs nearly completed, and for which it is not desirable to open a secondary account; such jobs, for instance, extend only over a few days before, and a few days after, the end of any month, and are then finished. In the B Sheets it is, therefore, necessary to provide for a succession of months. It must also be remembered that these accounts are a summary of the expenditure on one specific item of a contract, as, for instance, the propeller shaft, or the cathead davits of H.M.S. ACORN, and must therefore contain the wages spent in, the materials used by, and the proportion of establishment charges for all and every trade which has in any way been employed upon such shaft or davits. With this explanation the debit side of the account presents no difficulties. On the credit side (Specimen No. 29) there are very few entries. A credit may appear for Scrap returned into Stores, because it is at times difficult to say what department is entitled to it, although the item of the contract may be sufficiently evident; and the final entry is a transfer to the C or Contract Account, which must be made when, and only when, the particular shaft, davit, or other detail involved is finally completed, and will have nothing further spent upon it.

The C Sheet is a summary of the entire contract—the Ledger Cost Account of the contract, as it were—and it will be found particularly valuable for reference when preparing further estimates and tenders. Specimen No. 30 will sufficiently show the form, but the entries on the debit side will be much more numerous. They, of course, will agree with the number of B Sheets, and these will be determined by the number of pieces in a machine, or of grouped items in more complicated structures—such as ships or marine engines. This division will usually be determined by the necessities of the Engineering manager. The debit side merely consists of transfers from B Sheets as they become completed. The credit side is a record of payments received, and of scrap material returned which cannot be credited to any particular portion of the work. The difference between the two sides is the profit or loss on the contract or job.

With Cost Accounts we reach the vanishing point of Engineering Accountancy. They are probably the most difficult portion of it, but many of the difficulties will disappear if the objects for which they are compiled are kept in view; if they are treated as records to assist the manager in the commercial portion of his business, and not as a sequence in a pedantic system of bookkeeping. Elasticity is, above all things, necessary if they are to serve their full purpose, and elasticity can be secured without sacrificing scientific accuracy of detail or result.

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